ARMORED MEDICAL RESEARCH LABORATORY

FORT KNOX, KENTUCKY

PROJECT NO. 7 - NIGHT VISION FROM TANKS

Report On

Sub-Project No. 7-8 - Comparison and Evaluation of Field and Laboratory Methods of Measuring Night Visual Acuity

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Action copies have been forwarded to Office of the Surgeon General, Occupational Hygiene Branch for approval and execution.

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1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY
Fort Knox, Kentucky

Project No. 7-8
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COMPARISON AND EVALUATION OF FIELD AND LABORATORY METHODS OF MEASURING NIGHT-SEEING ABILITY OF GROUND TROOPS

1. PROJECT: No. 7 - Night Vision From Tanks; Report on Sub-Project 7-8, Comparison and Evaluation of Field and Laboratory Methods of Measuring Night Visual Acuity.

a. Authority: Letter, Commanding General, Headquarters Armored Force, Fort Knox, Kentucky, 400.112/6 GNOHD, dated September 24, 1942.

b. Purpose: To evaluate the usefulness of various laboratory tests to measure night-seeing ability of ground troops and to choose a test suitable for selection of ground troops for night operations.

2. DISCUSSION:

It is desired to choose from available test methods one which will select men with reasonable accuracy for night-seeing ability for ground night operations. One basis for selection is to test men with the available instruments and to compare these results with the ability to perform visual tasks in the field, the tasks to be of the type normally required of ground troops during night operations. Such a method was employed after preliminary tests indicated that it was possible to devise a field test which could be properly scored and which involved visual tasks of the types normally encountered by ground troops. The instruments and tests compared were AAF Night Vision Tester, Luckiesh-Moss Variable Contrast Charts, S.A.M. Tester, Luminous Plaque and the A.M.R.L. Field Test. Description of test and test equipment and results are given in Appendix.

3. CONCLUSIONS:

a. The AAF night vision tester will enable selection of men for night field operations with sufficient accuracy for practical purposes. The size and cost of the equipment and the requirement of a special dark-room precludes its use in the field or away from well organized training stations.

b. The Luckiesh-Moss variable contrast charts, the S.A.M. tester and certain of the other laboratory tests were less satisfactory.

c. The luminous plaque of the type now under study by Aero-Medical Research Laboratory will allow the selection of men on the basis of night-seeing ability. Little equipment is needed and the device is convenient and

simple to use. Slight modification in testing technique will improve this test.

4. RECOMMENDATIONS:

a. That the luminous plaque described in appendix be considered satisfactory as a night vision tester for selection of ground troops for night operations.

b. Recommendation for basis of issue and operating procedure for testing are incorporated in a final report now under review.

Prepared by:
Lester B. Roberts, Major, SnC
Wendell E. Mann, 1st Lt., MAC

APPROVED BY Willard Machle
WILLARD MACHLE,
Colonel, Medical Corps,
Commanding.

4 Incls.
#1 - Appendix
#2 - Table I
#3 - Figs. 1 thru 33
#4 - Photographs 1 thru 12

APPENDIX

DESCRIPTION OF TESTS AND TEST EQUIPMENT

AMRL FIELD TEST

The test was carried out in a large bowl-shaped clearing, approximately 1000 feet by 500 feet, completely surrounded by hills and trees and well away from interfering lights or sky glow. Targets of various size, shape and contrast, tanks, trucks, etc. are placed around and at various distances from each of three stations located in the clearing. (Fig. 1, Table I) The stations are sufficiently far apart so that the targets of one station cannot be seen from the other stations. A white tape, used to guide subjects to and between stations, runs from a starting point in the woods to Station No. 1 thence to Stations No. 2 and No. 3, and continues from the last station into the woods at the far end of the clearing.

Subjects are brought to the area after dark and remain in the woods at the near end of the clearing for at least one half hour for dark adaptation. During this time, the nature of the test and procedure to be followed is explained. Sample targets are shown and the need and methods for using parafoveal vision and scanning are demonstrated.

Three trained operators, one at each station, conduct the test. The first man of the group to be tested follows the white tape from the starting point to station No. 1 where he turns over to the operator a score sheet previously supplied him. He then starts scanning from a point designated by the operator. The subject points out the targets which he sees giving shape and location and noting any further detail, such as a cross or C, seen in the target. If he thinks he sees a vehicle he so states and identifies it if he can do so. He scans through 360°, taking as much time as desired. Three to five minutes is the average time required at each station. The operator records on the data sheet the target number and shape, and notes all description given by the subject. He remains behind the subject and may use a flashlight fitted with red filter while recording data. When finished, the subject is sent to the next station where the same procedure is repeated. After station No. 3 the subject follows the tape to a collecting point where he remains until all men of the group are tested.

Scoring

a. The following procedure was followed:

(1) If target was not seen--space left blank
(2) If seen but shape or detail not recognized an X (one point scored)
(3) If seen and shape described, XX or 2 points
(4) If seen and shape and distinctive central marking (cross, circle or C) identified XXX or 3 points
(5) If seen, shape and both kind and full description of central marking are given XXX or 4 points are scored. (by an underline)

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b. In case of vehicle:

(1) If a form is seen but not identified, X or 1 point
(2) If form is seen and believed to be a vehicle, XX or 2 points
(3) If identified as as a vehicle, XXX
(4) If correctly identified as to kind of vehicle, XXX (4 points)

c. For every three wrong answers, without regard to target or sequence, one point is deducted from the total score.

The scores for a test group are collected and tabulated on the forms shown in Figs. 2, 3, 4, etc.

AAF TEST

This is an automatic instrument capable of testing six to eight men at one time. The subjects, after indoctrination and after becoming fully dark adapted, are seated before automatic scorers twenty feet in front of an illuminated circular target carrying a Landolt ring subtending one degree at twenty feet. During the test the target appears for seven seconds and disappears for nine seconds then reappears again with the ring in a new position for another seven seconds, etc. During the seven second presentation, the subject attempts to orient the break in the Landolt ring and sets an automatic recorder, which can be adjusted by feel, to a position corresponding to the determined position of the break in the ring. Forty presentations of the target are given with random selection of the ring positions. The first five presentations are given with a background brightness of log 6.25 micro-micro lamberts. The brightness is reduced 0.25 log unit for each succeeding five presentations, making the final brightness log 4.5 micro-micro lamberts.

The score obtained is expressed as the total of the positions determined correctly.

LUCKIESH-MOSS

The Luckiesh-Moss Low Contrast Test Chart consists of two rows of two digit numerals on a white background. Subjects are dark adapted for at least thirty minutes before taking this test. There are twenty numerals that decrease uniformly in contrast from 37.8 percent for the first pair to 6.0 percent for the last pair. The chart is illuminated at both 0.0081 foot lamberts and 0.0147 foot lamberts. The subjects are required to read as many digits as possible from a distance of ten feet at both brightness levels. The chart is first read at the low brightness level. The subjects are given as much time as desired. In our tests, three scores were recorded (1) number of correct digits read at low brightness level, (2) number of correct digits read at high brightness level, (3) total digits read at both brightness levels.

S.A.M. TESTER

This is an individual threshold-form recognition tester. The target consists of a small radium disc approximately $1\frac{1}{2}$" in diameter. In the center of the disc is a Landolt ring approximately $\frac{1}{2}$" in diameter. Neutral filters

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placed in front of the disc reduce the brightness as desired and the position of the Landolt ring can be changed to any one of four positions. Nine brightness levels are possible--these covering essentially the same range as the AAF tester. The distance of the target from the eye is maintained at approximately 15" by a cord fixed to the instrument and held firmly aroun the subject's neck. The score is recorded as the lowest brightness level at which consistent recognition of the position of the break in the Landolt ring is made.

FIELD LANDOLT RING TEST

This test was conducted in the field at night, using a four inch character Landolt ring painted on a white plywood disc twenty-two (22) inches in diameter. The disc was rotated randomly by an operator to one of four positions. The score is taken as greatest distance the subject is consistently able to determine the orientation of the Landolt ring.

LUMINOUS PLAQUE TESTER

This is an individual threshold-form recognition tester. The target is a circular radium-salt disc approximately four inches in diameter with a Landolt ring with a diameter of about two (2) inches mounted in the center. The brightness of a background is 0.12 micro lamberts.

The operator holds the plaque five feet in front of the subject, using various orientations. If the subject gets three out of four or six out of eight positions correct the operator moves one foot farther away and continues the test. The distance from the subject to the operator is controlled by a twelve foot cloth tape extending around the subject's neck to the operator. The tape has tabs set at one foot intervals beyond five feet.

The score is expressed in terms of the last distance in feet, at which the subject is consistently able to determine the orientation of the Landolt ring.

Correlation Between Field and Laboratory Tests

PART I - Field Vs. AAF and Luckiesh-Moss Tests

In figures 2, 3, 4 and 5 the individual field test scores of 156 men in groups of 43, 35, 44 and 36 men tested on different nights are given. Tests were conducted on moonless nights only and while the illumination was uniform at about 0.00015 foot candles throughout; the results obtained with different groups are reported separately because of possible slight differences in illumination on the different nights.

The 156 men were also tested in the laboratory with the AAF tester and the Luckiesh-Moss varying contrast charts. The field and laboratory test score distributions are shown in Figs. 6, 7, and 8. Scatter diagrams of the field test scores vs. AAF scores are shown for each group in Figs. 9, 10, 11 and 12. The correlation coefficient between the two scores (r), the mean field score (MF), the mean AAF score (MAAF) are given for each group.

In order to establish the practical relationship between the AAF and the Field test, the scatter diagrams were divided with vertical and horizontal percentage lines as shown. The vertical 5% line to the right separates the highest 5% AAF scores from the remaining 95%, the vertical 5% line to the left separates the lowest 5% AAF scores. The two vertical lines then separate the AAF scores into three groups; the highest 5%, the middle 90% and the lowest 5%. In a similar manner the horizontal lines were drawn to separate the field scores into corresponding percentage groups. The two vertical lines and the two horizontal lines for a given percentage then divides the chart into nine rectangles. Points occurring in the upper right hand rectangle, the middle rectangle and the lower left hand rectangle represent agreement between AAF and Field Test. Points occurring in the remaining rectangles represent disagreement and degree of disagreement between the two tests. Dividing the scatter diagrams as shown for various percentages and combining the data for all groups gives points for the construction of Figs. 13 and 14 which summarizes the agreement expected between the AAF and Field test when selection is made on the basis of highest or lowest percentage selected by the AAF test.

For example (Fig. 13) of the 25% highest scores by the AAF test 3% were included in the lowest 25% as rated by the field test, 7% were included in the 50% middle class as rated by the field test and 15% rated highest by both the AAF and field tests.

Similarly (Fig. 14) of the 25% lowest scores by the AAF test 1.5% were included in the 50% middle class as rated by the field test and 11.5% rated lowest by both AAF and Field tests.

Within the limits of definition assigned above, the highest group may be called superior, the middle group average and the lower group poor. This designation assists somewhat in establishing usable corresponding limits for the test.

The following is a summary tabulation of the correlation coefficients of the Field vs. Laboratory Test scores:

Group	No. Men	L.M. Low	L.M. High	L.M. Total	AAF
1	43	.416	.318	.351	.634
2	35	.204	.349	.305	.455
3	44	.499	.381	.411	.626
4	36	.398	.620	.526	.683

It may be seen that in general the AAF test correlates well with the field test procedure and will sort the superior and poorest men reasonably well.

PART II - Test-Retest of Field and Laboratory tests.

Twenty men were given four field and four laboratory tests with each of the following; AAF and S.A.M. instruments and the Luckiesh-Moss varying contrast charts. They were also given a field Landolt ring test.

For the field test the target distribution was entirely changed between tests to preclude memorizing target locations. Moonless nights only were used and the general illumination was checked each night. The illumination was constant at about 0.00015 foot candles.

Scores obtained on four successive field tests of a group (A) of twenty (20) men are given in Figs. 15, 16, 17 and 18. Correlations between test and retests are given in Table II. Scatter of AAF scores vs. field scores for each test is shown in Figs. 19, 20, 21 and 22. The average score for each man during the four successive field tests as compared with the average for each man of his four successive AAF tests is shown in Fig. 23, similarly mean individual results of field test and of four Luckiesh-Loss scores in Figs. 24, 25 and 26, averages for field test vs. average of four S.A.M. tests in Fig. 27 and averages of field test vs. the one field Landolt ring test in Fig. 28.

TABLE II

Field Test - Retest Correlation Coefficients

Field Test No.	Vs.	Field Test No.	r
1		2	.854
1		3	.856
1		4	.684
2		3	.889
2		4	.904
3		4	.807
		Average	.832

AAF Test - Retest Correlation Coefficients

AAF Test No.	Vs.	AAF Test No.	r
1		2	.897
1		3	.682
1		4	.843
2		3	.832
2		4	.917
3		4	.944
			.852
		Average	.852

Correlation coefficients of interest are given below:

LUCKIESH-MOSS TEST - INTEST CORRELATION COEFFICIENTS

Luckiesh-Moss High Score No.	Vs.	Luckiesh-Moss High Score No.	r
1		2	.798
1		3	.662
1		4	.729
2		3	.833
2		4	.573
3		4	.246
		Average - - - -	.640

Luckiesh-Moss Low Score No.	Vs.	Luckiesh-Moss Low Score No.	r
1		2	.909
1		3	.598
1		4	.738
2		3	.524
2		4	.491
3		4	.626
		Average - - - -	.641

Luckiesh-Moss Total Score No.	Vs.	Luckiesh-Moss Total Score No.	r
1		2	.869
1		3	.630
1		4	.774
2		3	.819
2		4	.849
3		4	.893
		Average - - - -	.806

FIELD VS. LABORATORY TEST CORRELATION COEFFICIENTS

			r	
Average 4 Field Tests	Vs.	Av. AAF	.769	(See Fig. 23)
		Av. L.M. High	.711	(" " 24)
		Av. L.M. Low	.769	(" " 25)
		Av. L.M. Total	.709	(" " 26)
		Av. S.A.M.	.508	(" " 27)
		1st L.M. High	.708	
		2nd L.M. High	.663	
		3rd L.M. High	.440	
		4th L.M. High	.705	
		1st L.M. Low	.832	
		2nd L.M. Low	.774	
		3rd L.M. Low	.440	
		4th L.M. Low	.862	
		1st L.M. Total	.765	
		2nd L.M. Total	.730	
		3rd L.M. Total	.473	
		4th L.M. Total	.801	
		1st S.A.M.	.623	
		Field Landolt Ring	.744	(See Fig. 28)
Field Test No. 1	Vs.	L.M. High - No. 1	.400	
		L.M. Low - No. 1	.571	
		L.M. Total - No. 1	.469	
Field Test No. 2	Vs.	L.M. High - No. 2	.482	
		L.M. Low - No. 2	.617	
		L.M. Total - No. 2	.556	
Field Test No. 3	Vs.	L.M. High - No. 3	.623	
		L.M. Low - No, 3	.541	
		L.M. Total - No. 3	.629	
Field Test No. 4	Vs.	L.M. High - No. 4	.724	
		L.M. Low - No. 4	.755	
		L.M. Total - No. 4	.753	

Field Test	Vs.	S.A.M. Test	r	No. of Men
1		1	.451	20
2		2	.495	20
3		3	.216	19
4		4	.595	17

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PART III - This section considers the Luminous Plaque Test scores in relation to Field and AAF test scores. Fig. 29 shows scatter of Luminous Plaque scores vs. Field scores for one test each for sixty-four (64) men. Fig. 30 shows scatter of Luminous Plaque scores vs. AAF scores for one test each for one hundred twenty-five (125) men. Fig. 31 shows scatter of individual averages for four Luminous Plaque scores vs. averages for four AAF Test scores for each of twenty-five (25) men. It also shows the scatter for the first Luminous Plaque Test vs. the last AAF test for this group. Test-Retest and other correlation coefficients of interest are tabulated below:

Field Test No.	Vs.	Luminous Plaque Test No.	r	No. of Men
1		1	.640	16
2		2	.597	25
3		3	.553	23
AAF Test	Vs.	Luminous Plaque Test	.789	125 (See Fig. 30)

LUMINOUS PLAQUE TEST - RETEST CORRELATION COEFFICIENTS

(54 Men)

Luminous Plaque Test No.	Vs.	Luminous Plaque Test No.	r
1		2	.662
1		3	.640
1		4	.644
1		5	.631
2		3	.694
2		4	.744
2		5	.632
3		4	.728
3		5	.660
4		5	.765
		Average - - - - -	.680

Figs. 32 and 33 show the percentages of high, middle and low by field test for selected percent high or low by the Luminous Plaque test, determined in the same manner as for the AAF-Field Tests in Part I.

Chart #1

TABLE 1

SIZE AND BRIGHTNESS OF FIELD TARGETS

Target No.	Shape-Size (inches)		Brightness (foot lamberts)
1	Square	21.5 x 21.5	26×10^{-6}
2	Circle	$17\frac{1}{2}$" diameter	20
3	Circle	22" "	55
4	Triangle	32 x 32 x 32	27
5	Circle	66" diameter	60
6	Circle	17.5 "	31
7	Circle	17.5 "	90
8	Triangle	32 x 32 x 32	30
11	Circle	45" diameter	31
12	Square	21.5 x 21.5	18
13	Circle	22" diameter	38
15	Circle	22" "	85
16	Circle	45" "	50
17	Square	21.5 x 21.5	45
19	Circle	66" diameter	65
20	Rectangle	30 x 36	60
21	Circle	45" diameter	40
22	Circle	45" "	65
23	Triangle	32 x 32 x 32	40
24	Circle	22" diameter	75
26	Square	21.5 x 21.5	50
27	Ambulance		9.5
28	Tank, M4		19
30	Circle	22" diameter	19
32	Rectangle	30 x 36	16
33	Triangle	32 x 32 x 32	31
34	Circle	66" diameter	75
35	Rectangle	30 x 36	45
36	Circle	22" diameter	47
37	Square	21.5 x 21.5	30
38	Triangle	32 x 32 x 32	22

TABLE 1

Incl #2

FIG. 1

PLAN OF AMRL NIGHT VISION FIELD TEST RANGE SHOWING DISTRIBUTION OF TARGETS ABOUT OBSERVATION POINTS

DISTANCES IN FEET, SIZE, BRIGHTNESS AND CONTRAST OF TARGETS GIVEN IN TABLE I

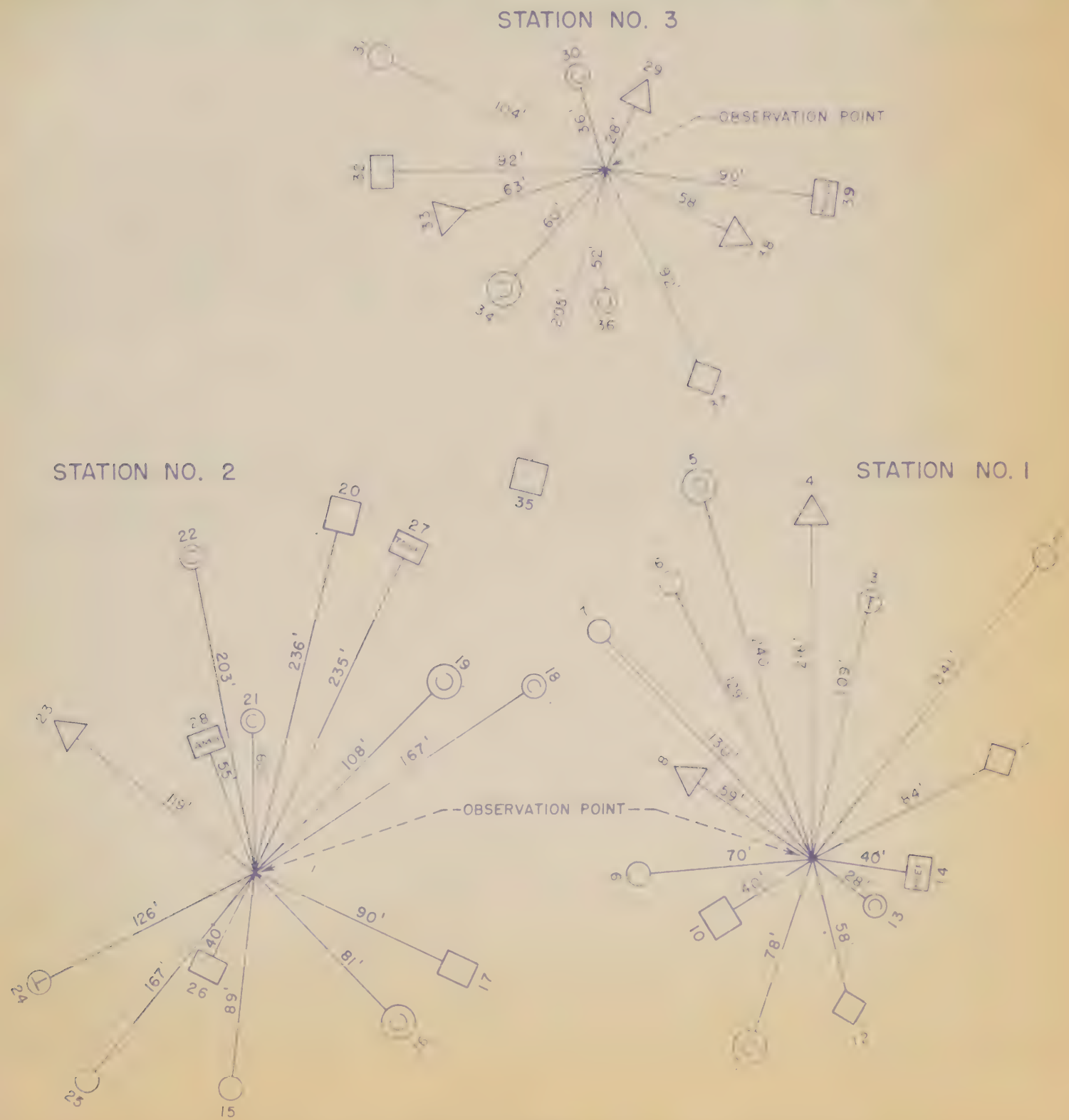


FIG. 1

INDIVIDUAL FIELD TEST SCORES

GROUP I

(43 MEN)

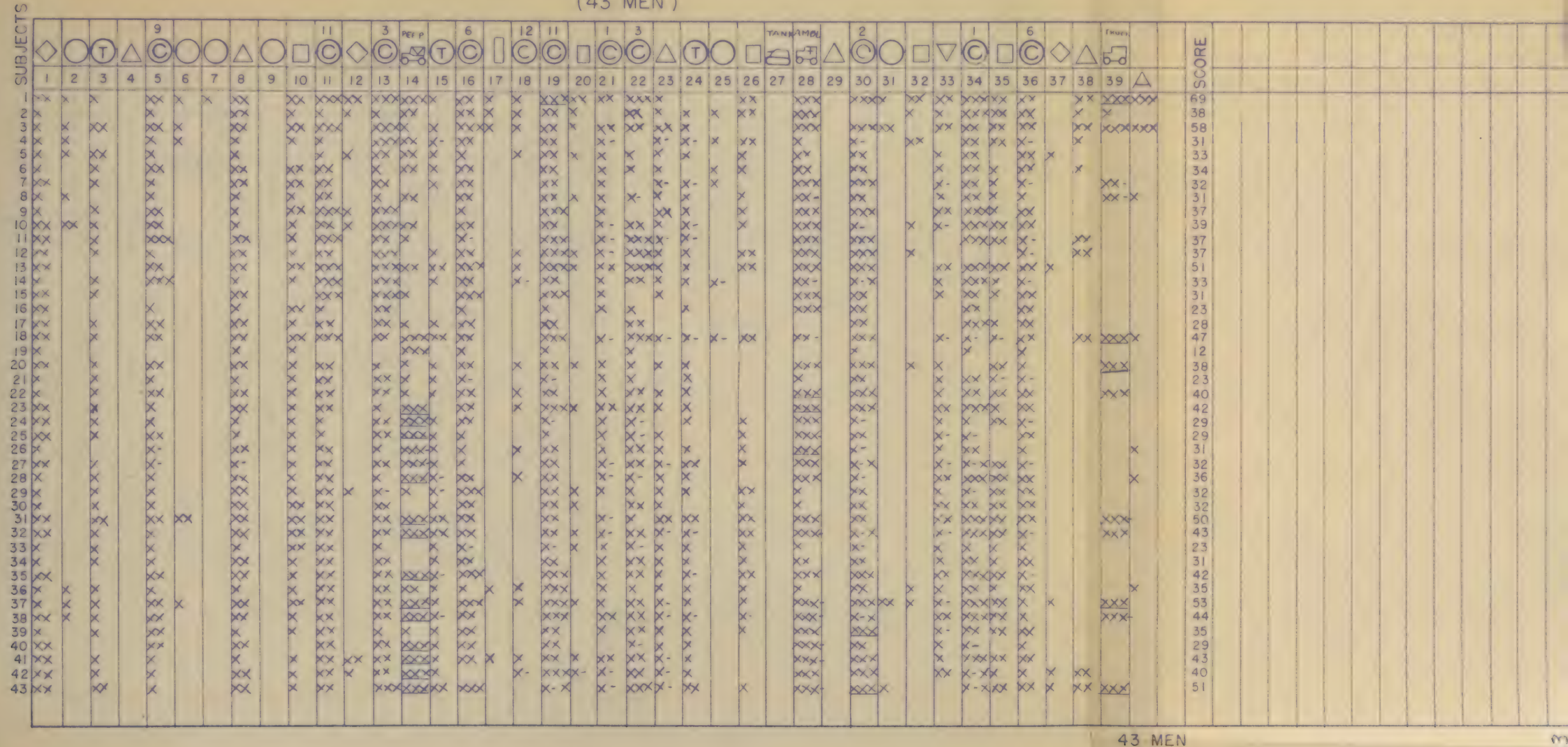


FIG. 2

INDIVIDUAL FIELD TEST SCORES

GROUP 2

(35 MEN)

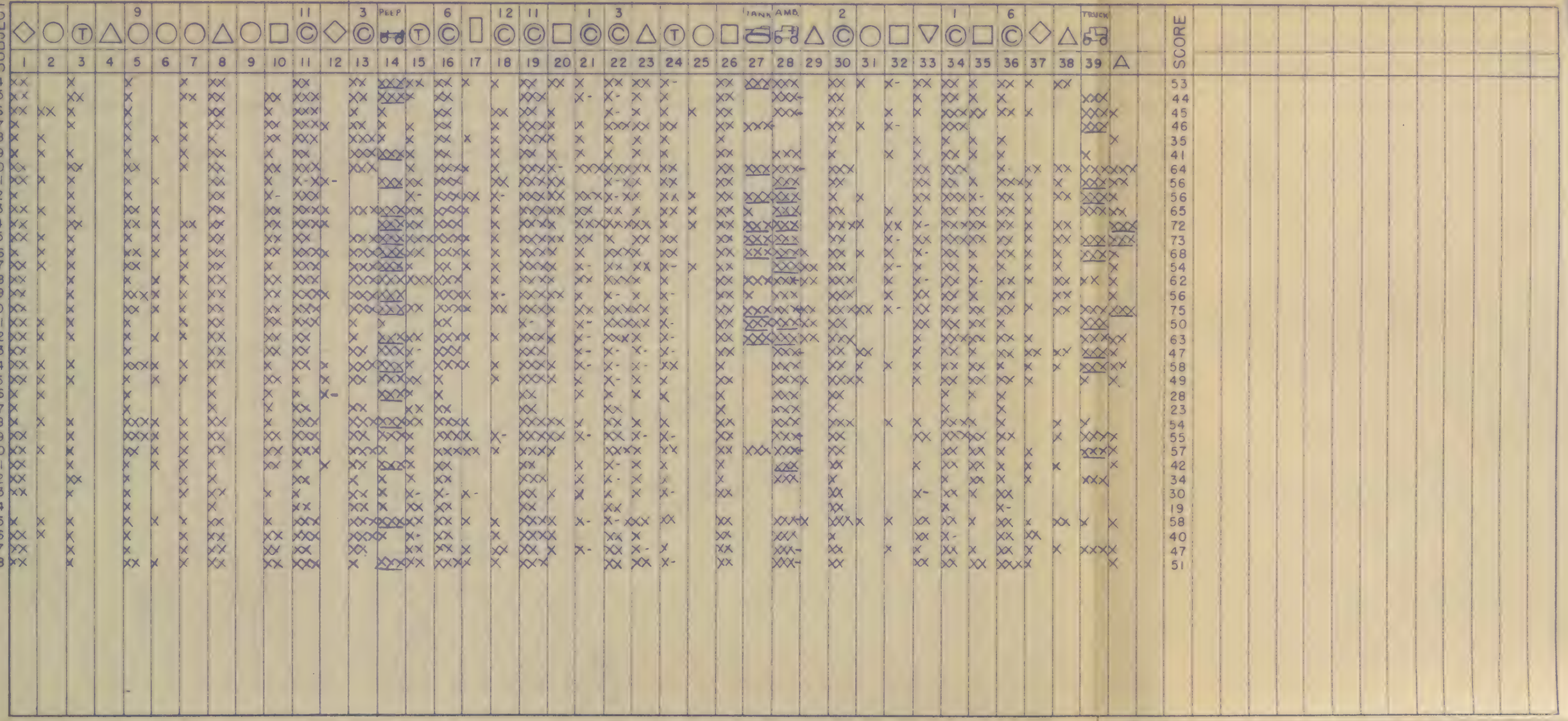


FIG. 3

INDIVIDUAL FIELD TEST SCORES

GROUP 3

(44 MEN)

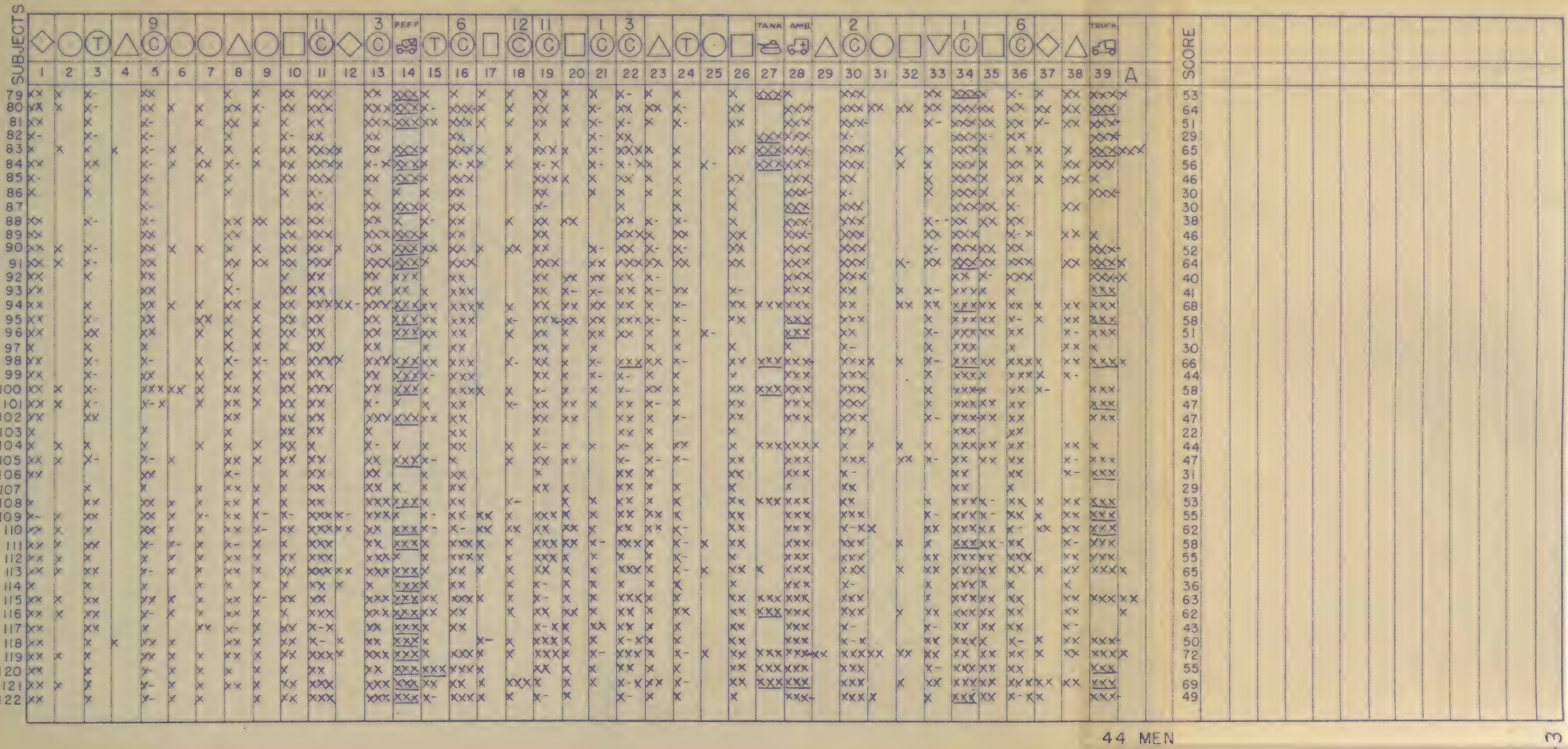


FIG. 4

INDIVIDUAL FIELD TEST SCORES

GROUP 4

(36 MEN)

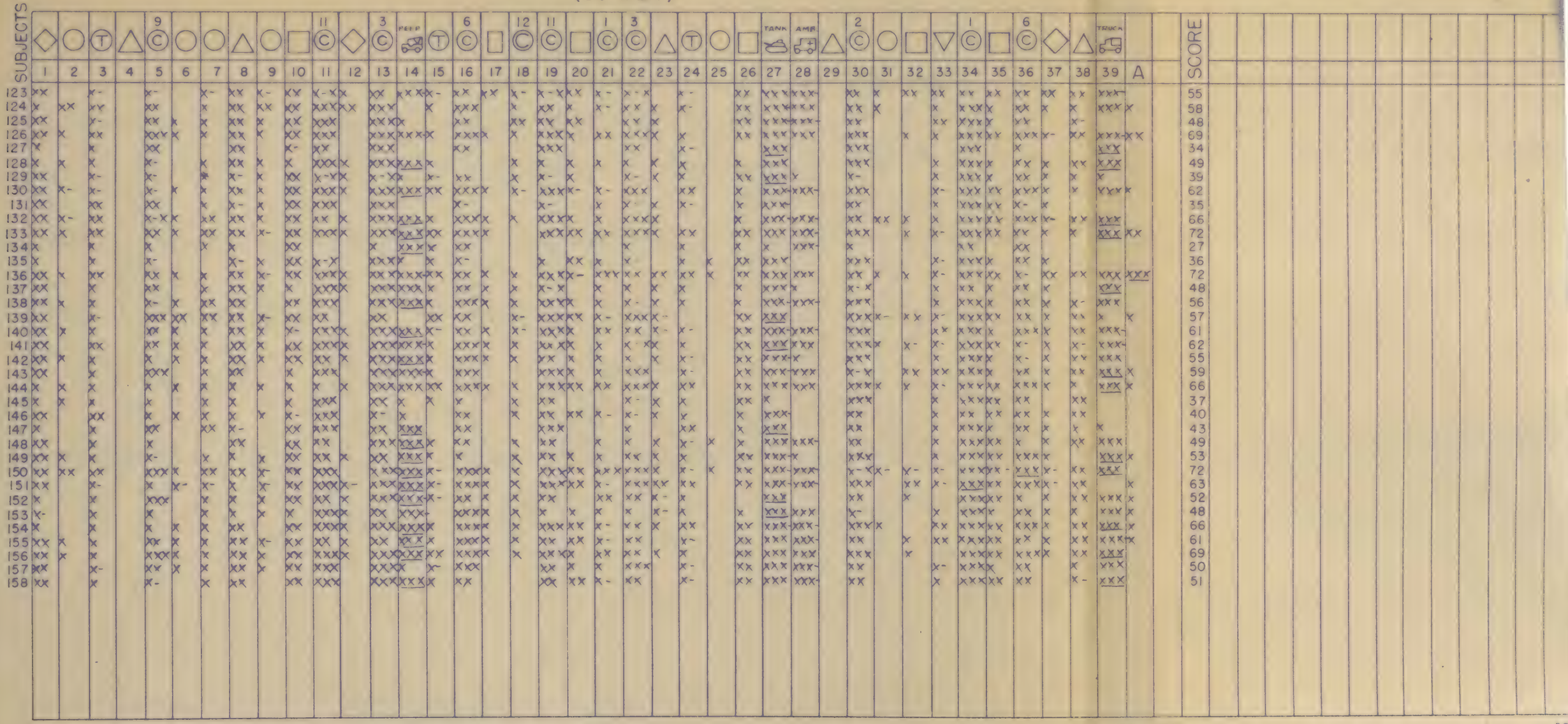


FIG. 5

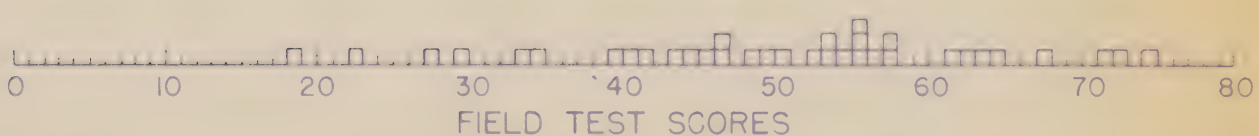
FIG. 6

HISTOGRAM SHOWING DISTRIBUTION OF FIELD TEST RESULTS WITH VARIOUS GROUPS

GROUP 1 - 43 MEN

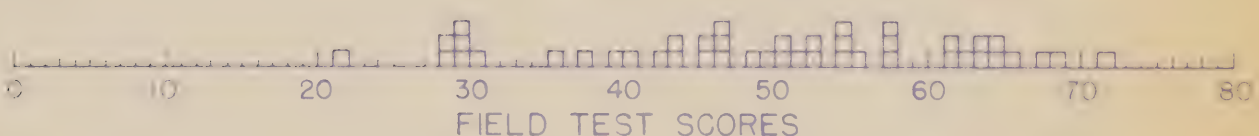
FIELD TEST SCORES

GROUP 2 - 35 MEN



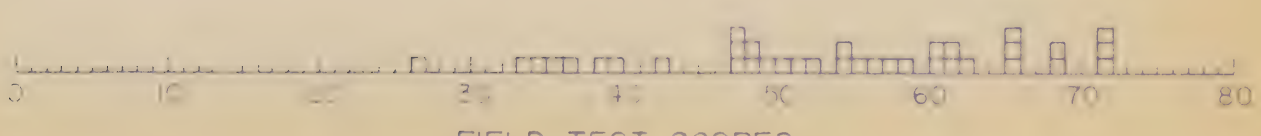
FIELD TEST SCORES

GROUP 3 - 44 MEN



FIELD TEST SCORES

GROUP 4 - 36 MEN



FIELD TEST SCORES

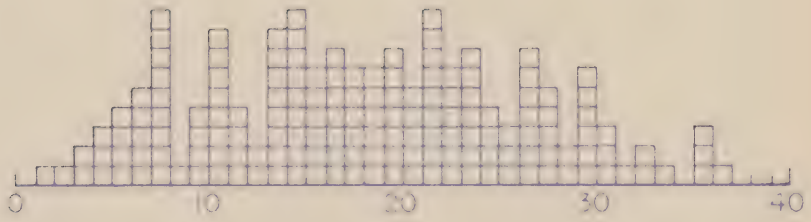
EACH SQUARE = 1 MAN

FIG. 6

FIG. 7

HISTOGRAM SHOWING
DISTRIBUTION OF A.A.F. SCORES

ALL GROUPS COMBINED



158 MEN

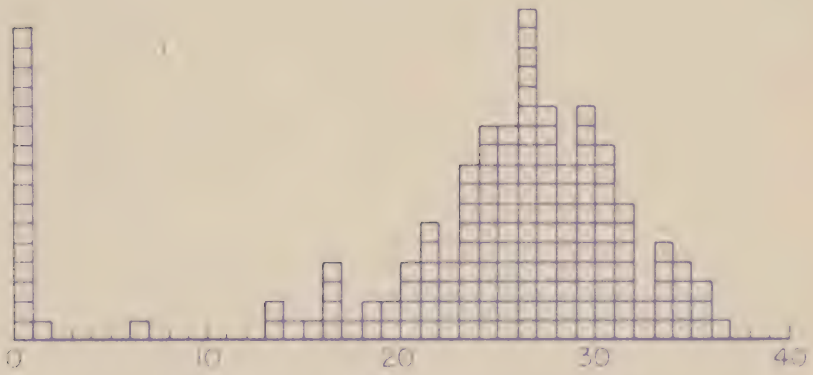
EACH SQUARE = 1 MAN

FIG. 7

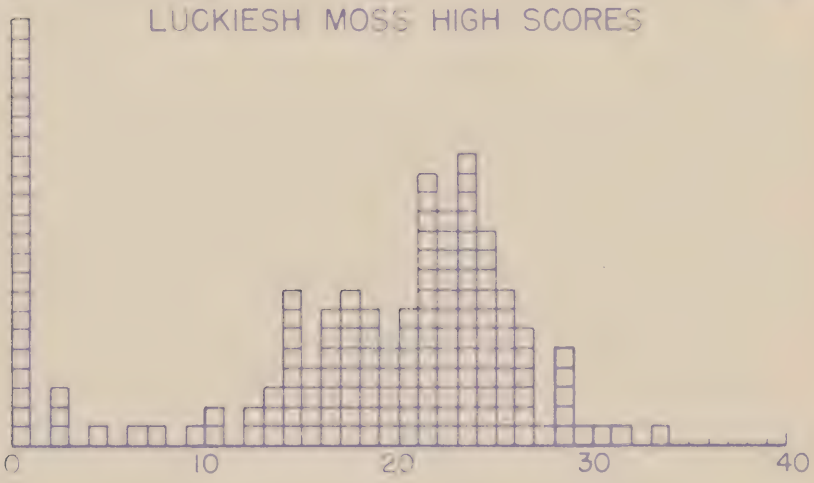
FIG. 8

HISTOGRAMS SHOWING DISTRIBUTION OF LUCKIESH MOSS SCORES

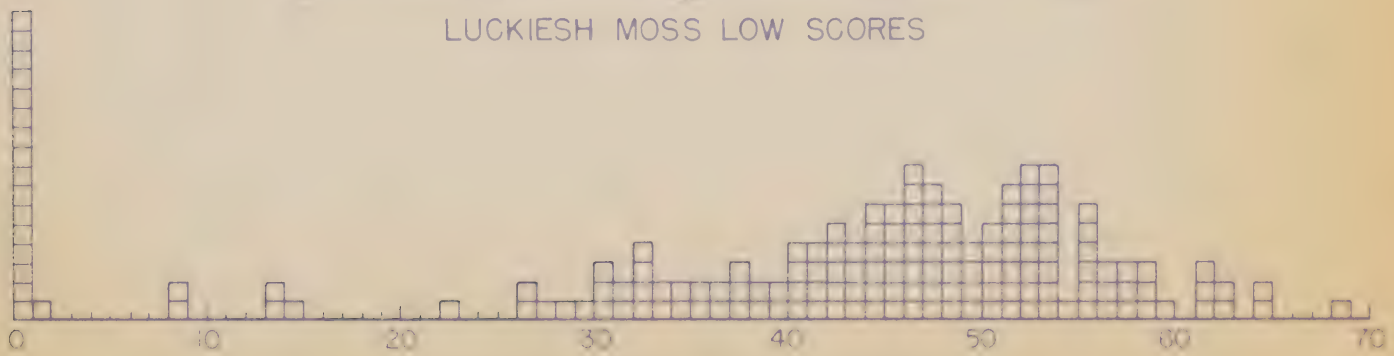
ALL GROUPS COMBINED



LUCKIESH MOSS HIGH SCORES



LUCKIESH MOSS LOW SCORES



LUCKIESH MOSS TOTAL SCORES

158 MEN EACH SQUARE = 1 MAN

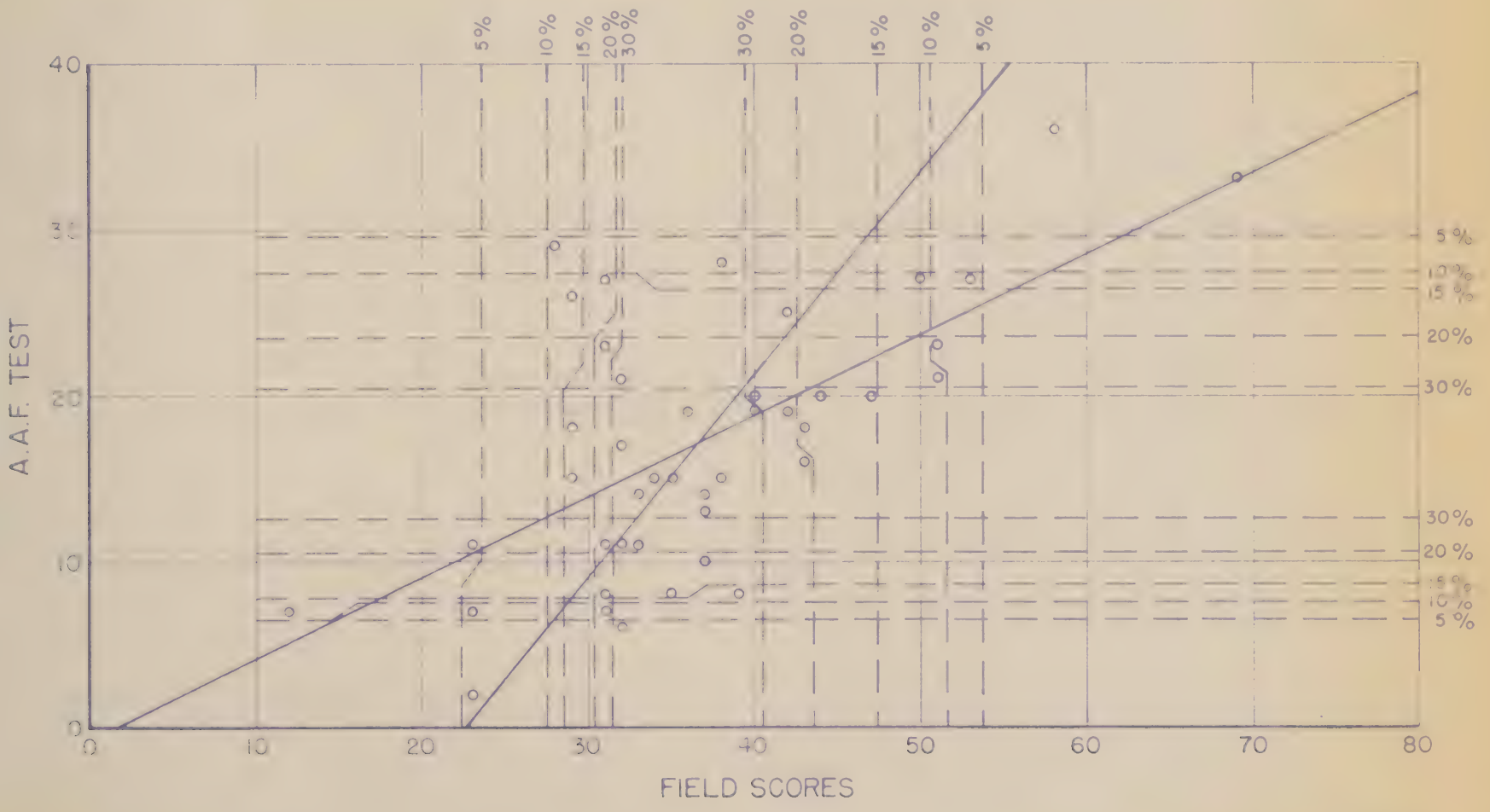
FIG. 8

FIG. 9

SCATTER DIAGRAM SHOWING CORRELATION
BETWEEN FIELD SCORES AND A.A.F. SCORES

GROUP I

(PERCENTILE DISTRIBUTION OF SCORES BY BOTH TESTS INDICATED)



r..... = 0.634
MF ..... = 36.83
MA.A.F. = 17.21

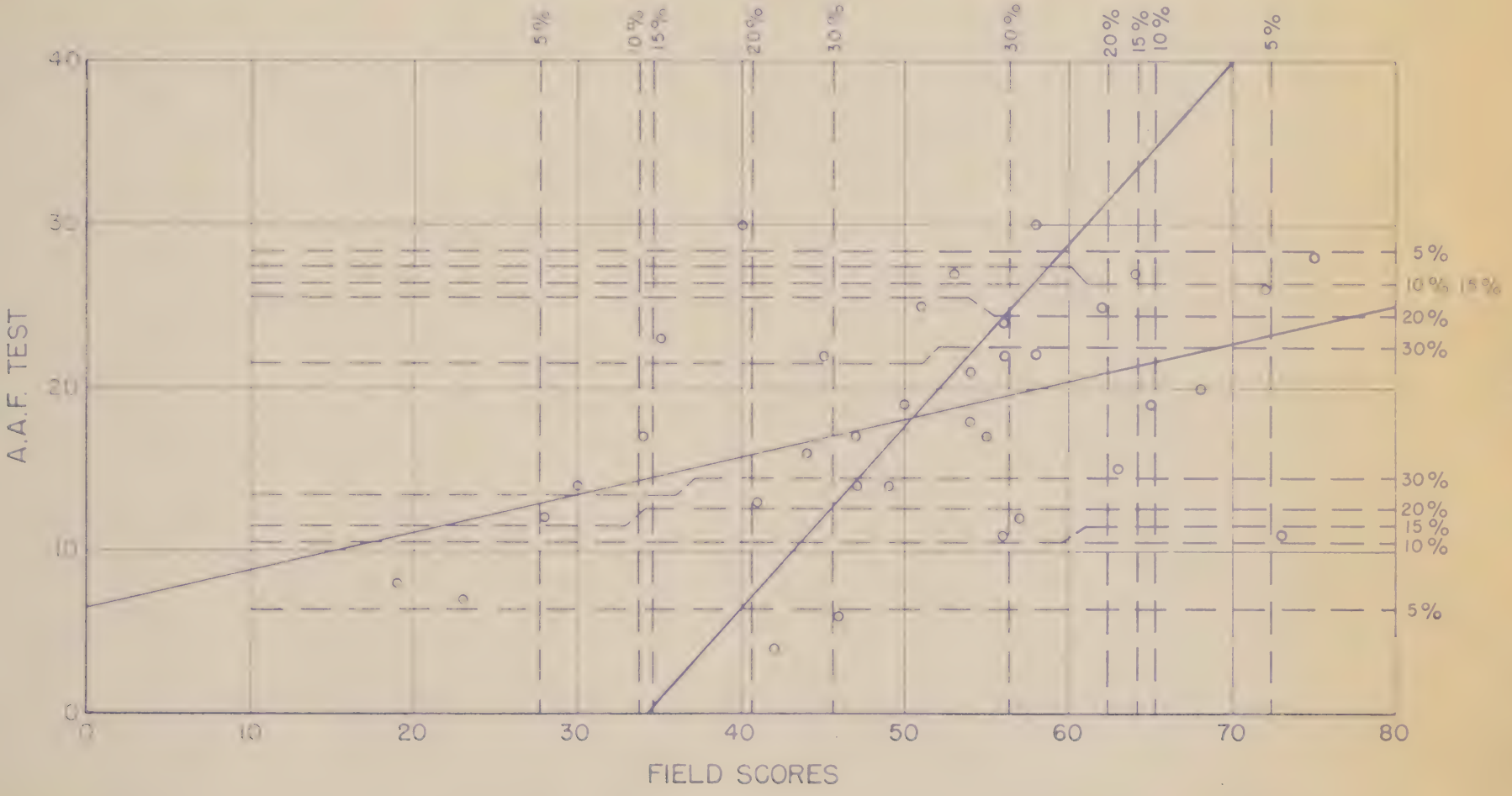
FIG. 9

FIG. 10

SCATTER DIAGRAM SHOWING CORRELATION BETWEEN FIELD SCORES AND A.A.F. SCORES

GROUP 2

(PERCENTILE DISTRIBUTION OF SCORES BY BOTH TESTS INDICATED)



r..... = 0.455
MF..... = 50.57
MA.A.F = 18.17

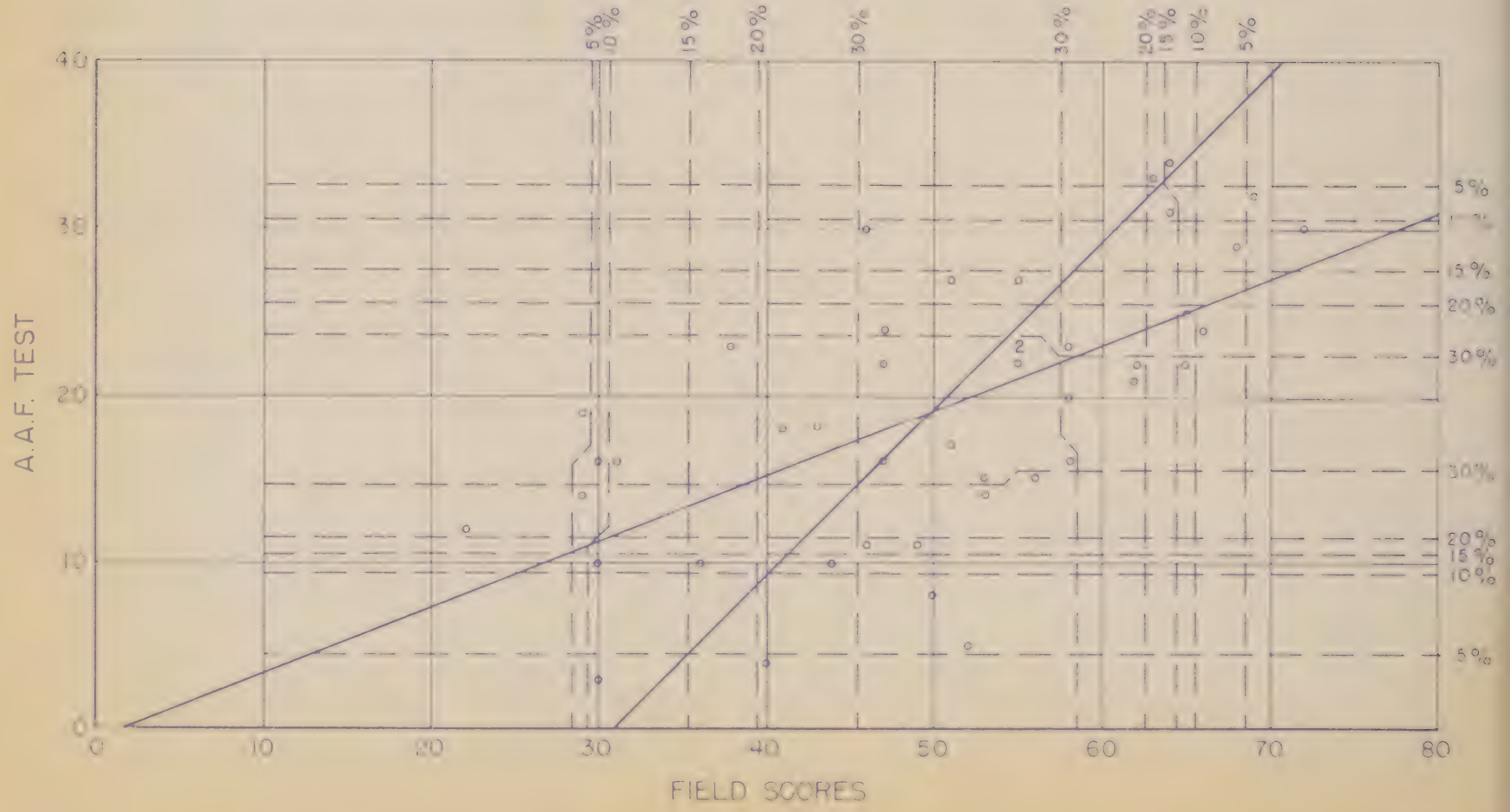
FIG. 10

FIG. II

SCATTER DIAGRAM SHOWING CORRELATION BETWEEN FIELD SCORES AND A.A.F. SCORES

GROUP 3

(PERCENTILE DISTRIBUTION OF SCORES BY BOTH TESTS INDICATED)



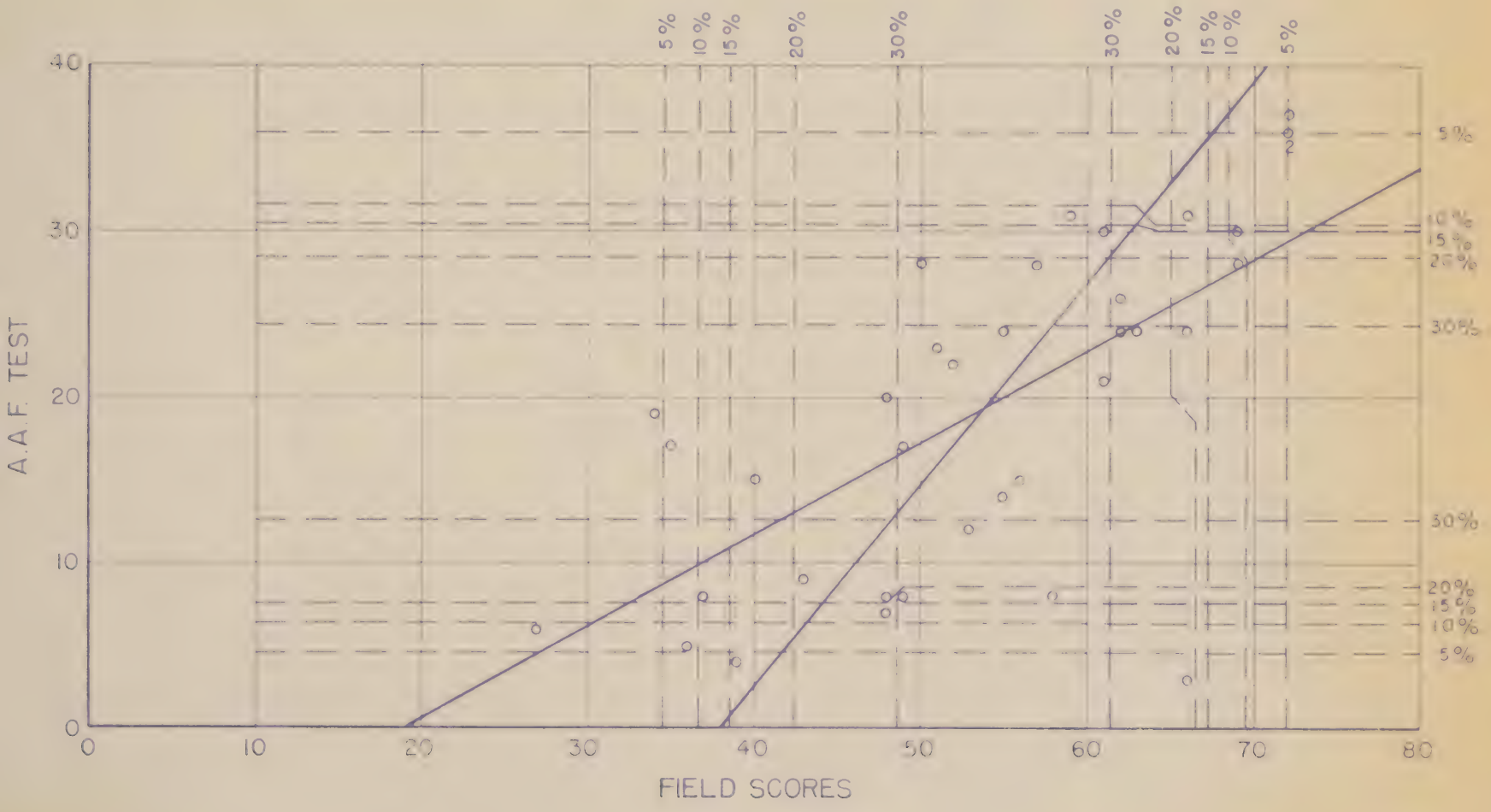
r..... = 0.626
MF.....=49.86
MA.A.F.=19.04

FIG. 12

SCATTER DIAGRAM SHOWING CORRELATION BETWEEN FIELD SCORES AND A.A.F. SCORES

GROUP 4

(PERCENTILE DISTRIBUTION OF SCORES BY BOTH TESTS INDICATED)



r..... = 0.683
MF.....=53.88
MA.A.F.= 19.38

FIG. 12

FIG. 13

PERCENT HIGH, MIDDLE AND LOW BY FIELD TEST
FOR SELECTED HIGHEST PERCENT BY A.A.F. TEST

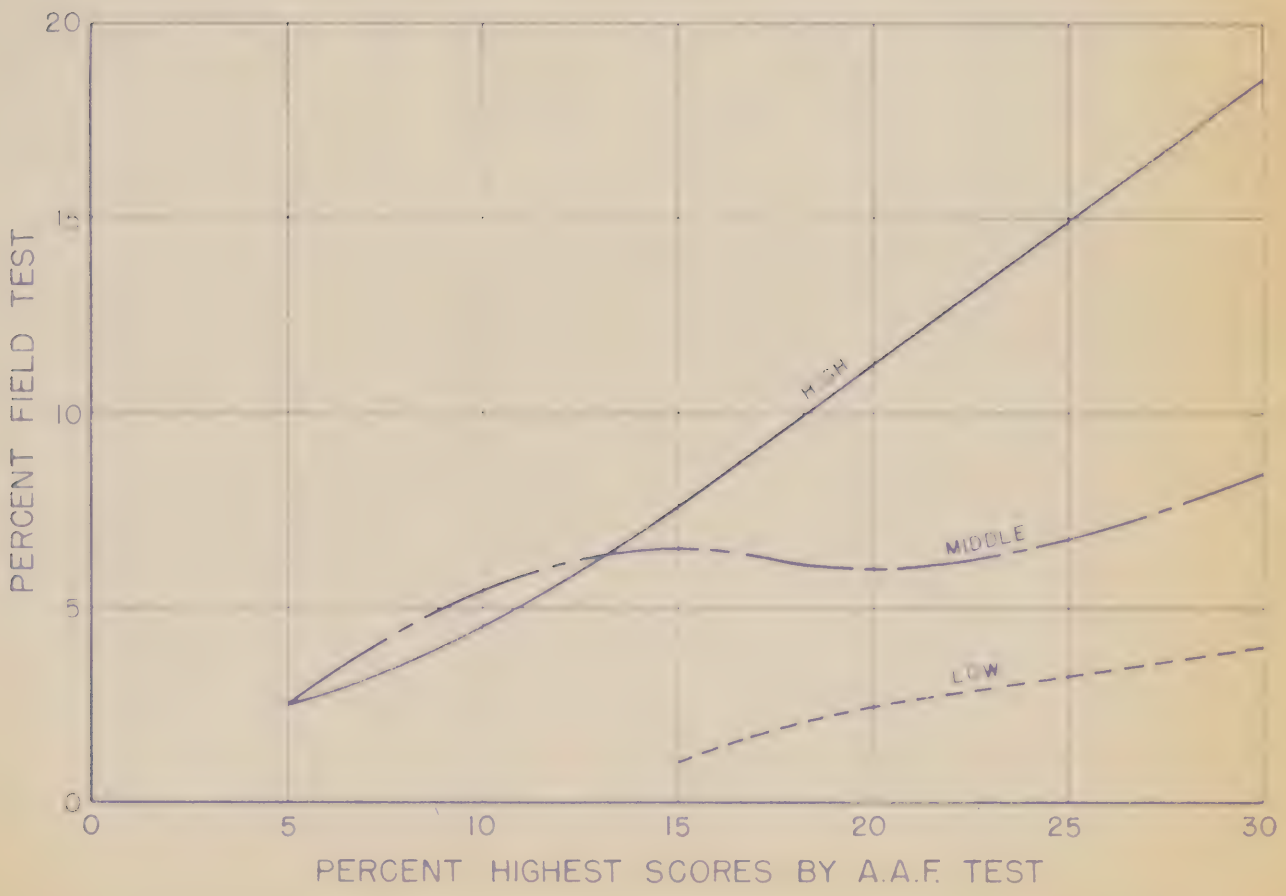


FIG. 13

FIG. 14

PERCENT LOW, MIDDLE AND HIGH BY FIELD TEST
FOR SELECTED LOWEST PERCENT BY A.A.F. TEST

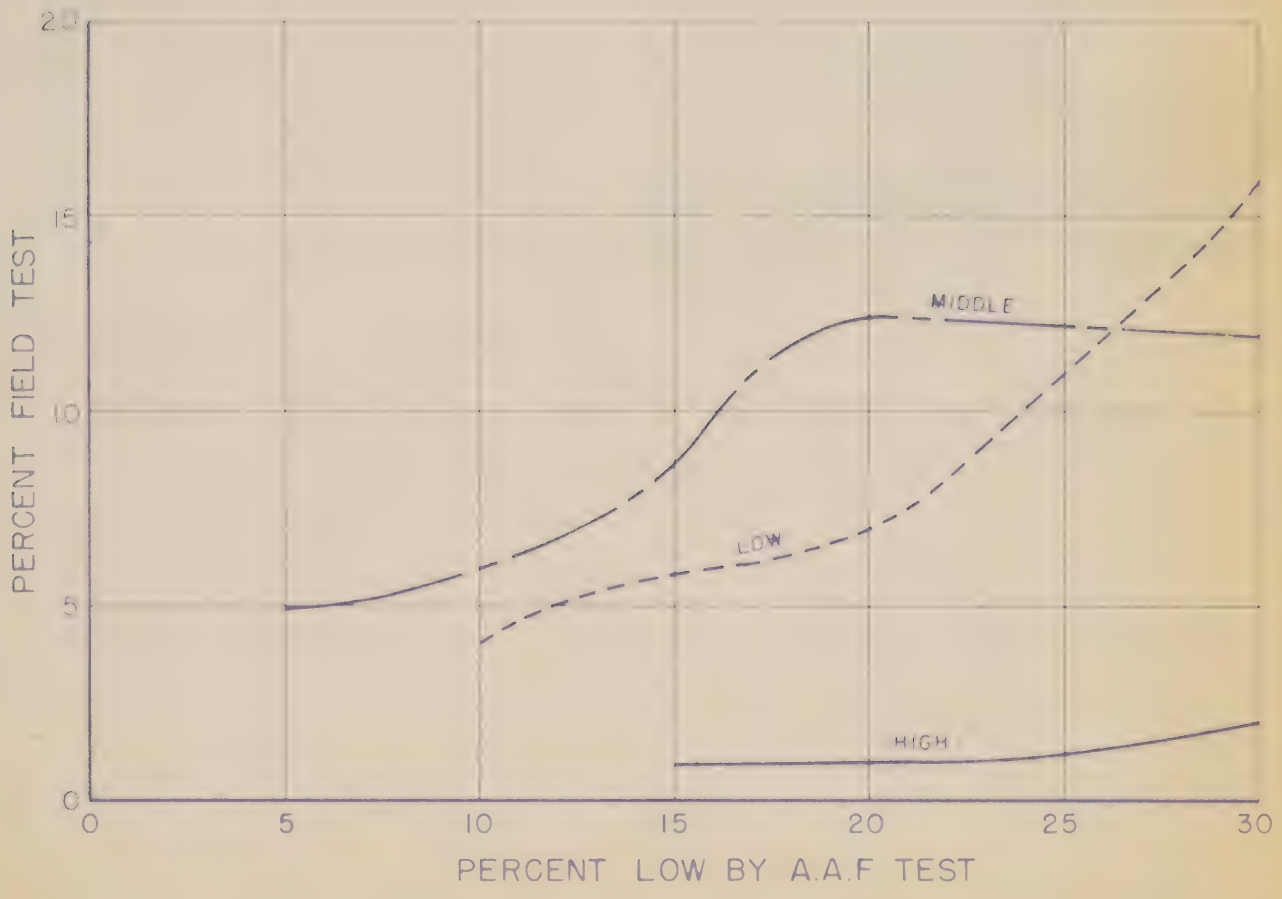


FIG. 14

RESULTS OF INITIAL TEST OF GROUP A

TEST I

(20 MEN)

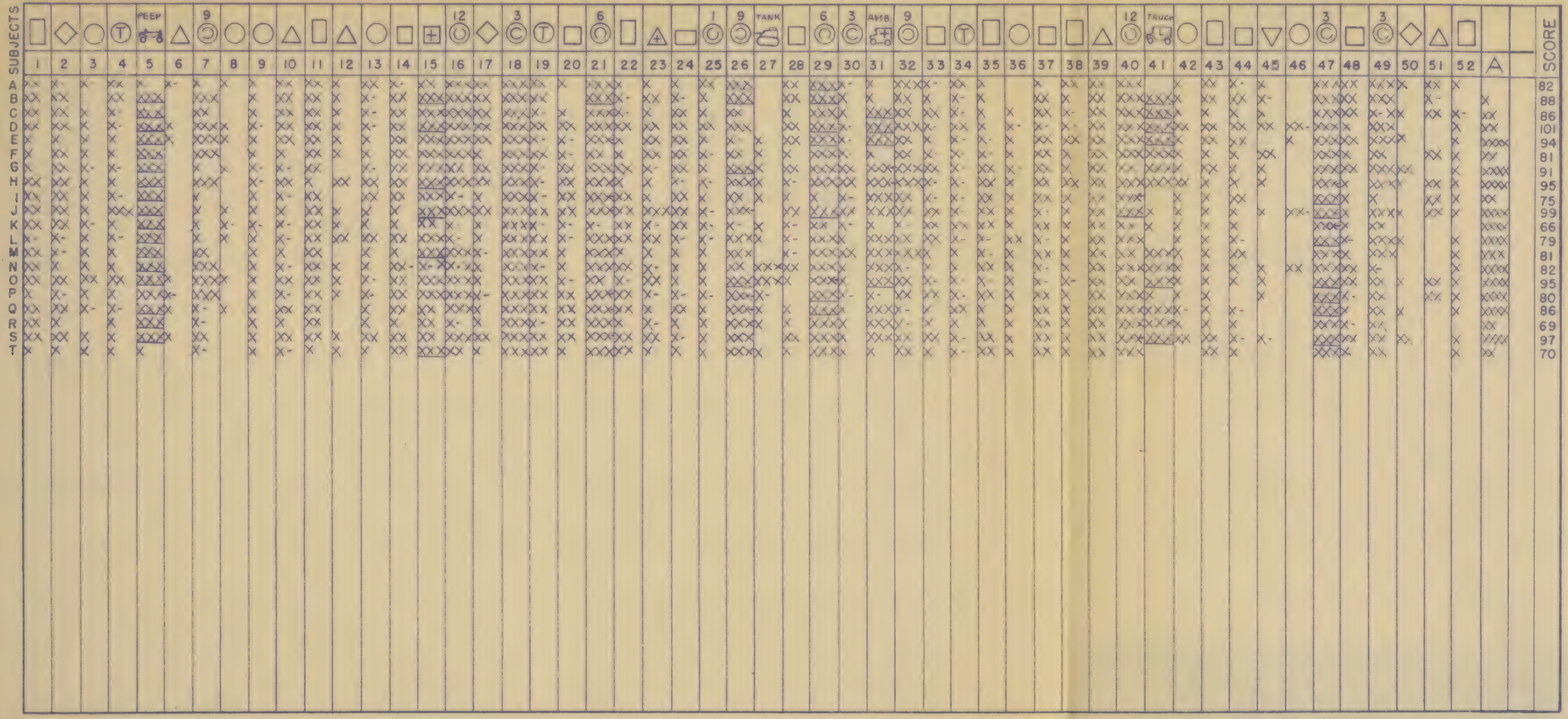


FIG. 15

RESULTS OF SECOND TEST OF GROUP A

TEST 2

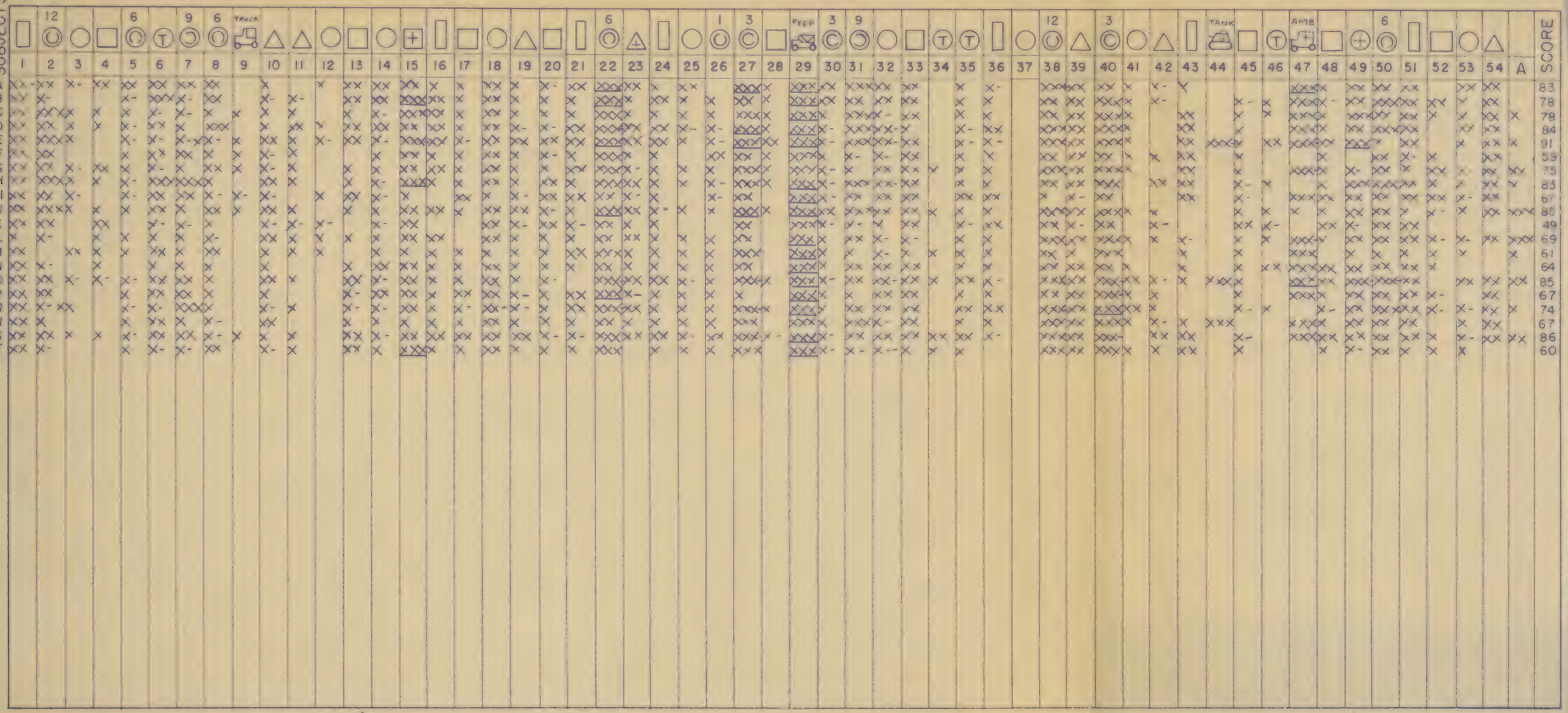


FIG. 16

RESULTS OF THIRD TEST OF GROUP A

TEST 3

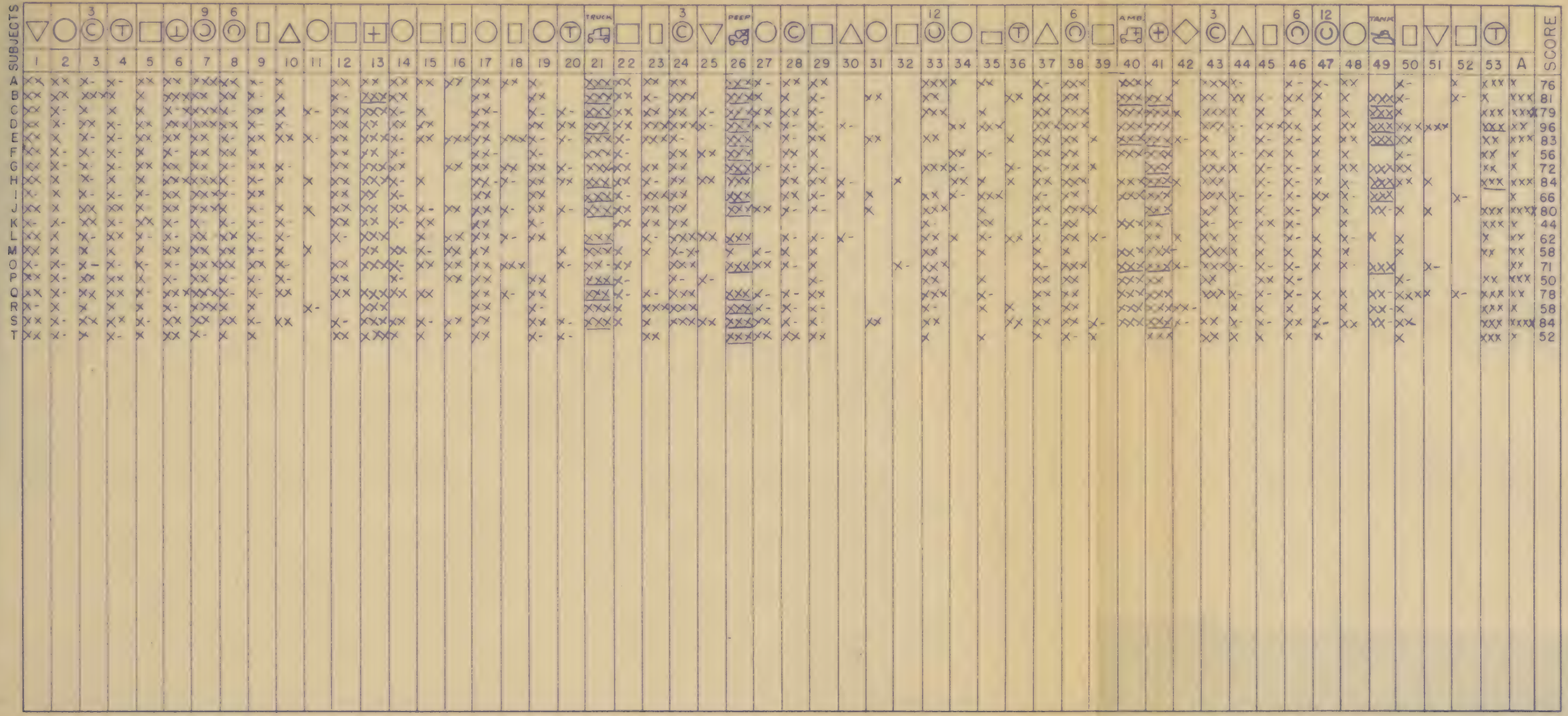


FIG. 17

RESULTS OF FOURTH TEST OF GROUP A

TEST 4

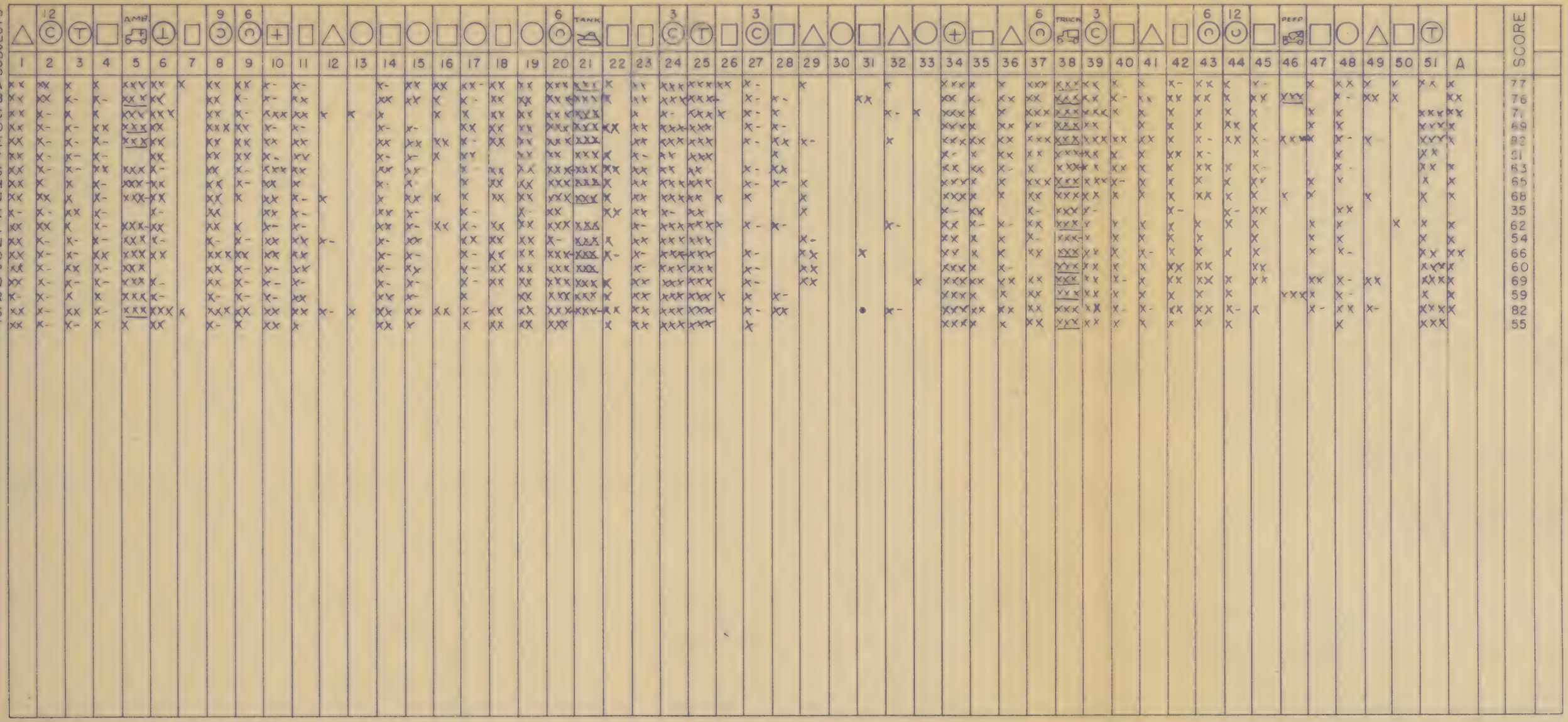
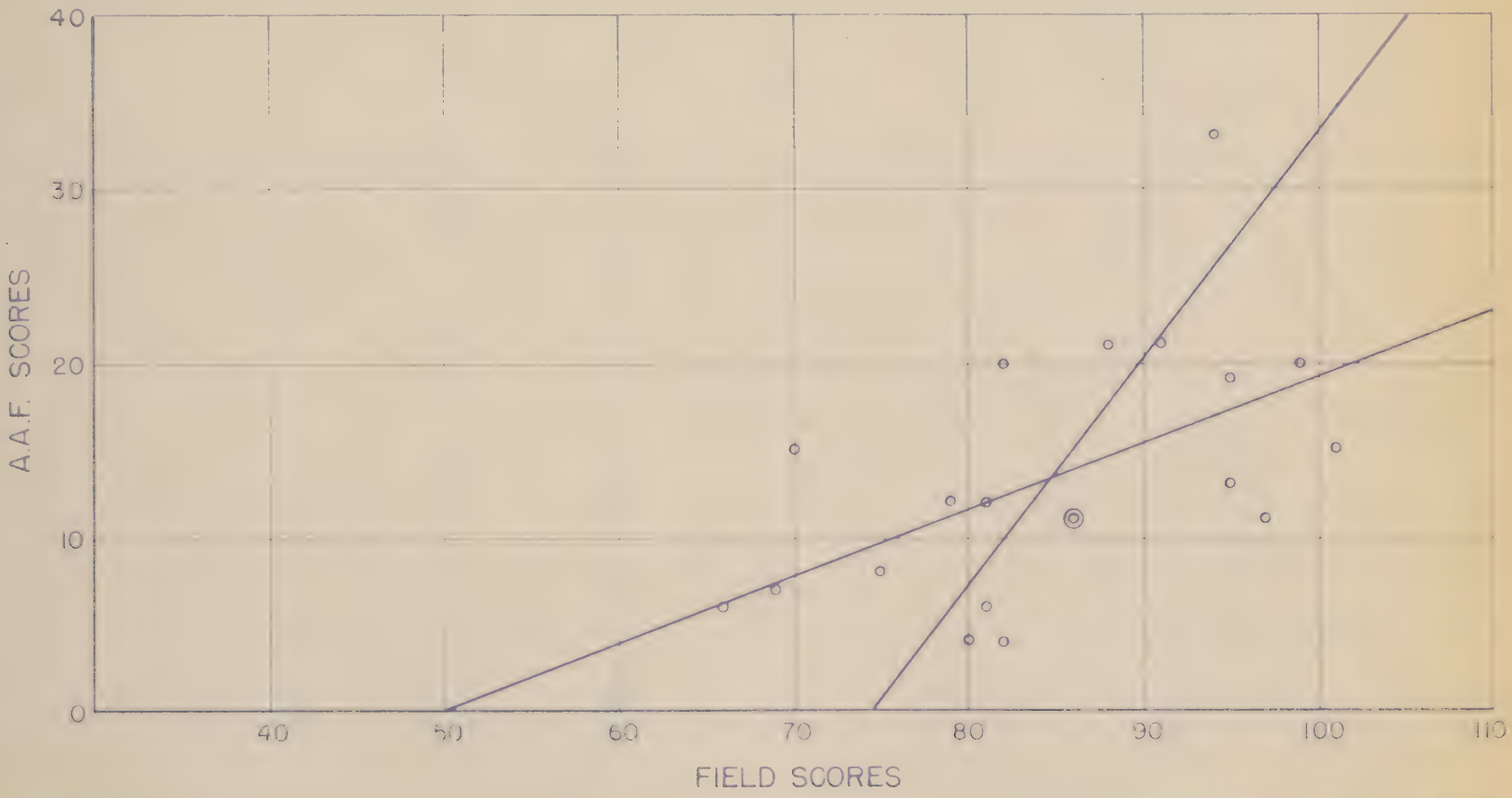


FIG. 18

FIG. 19

SCATTER DIAGRAM SHOWING RELATIONSHIP BETWEEN FIELD SCORES AND A.A.F. SCORES FOR GROUP A

FIRST TEST



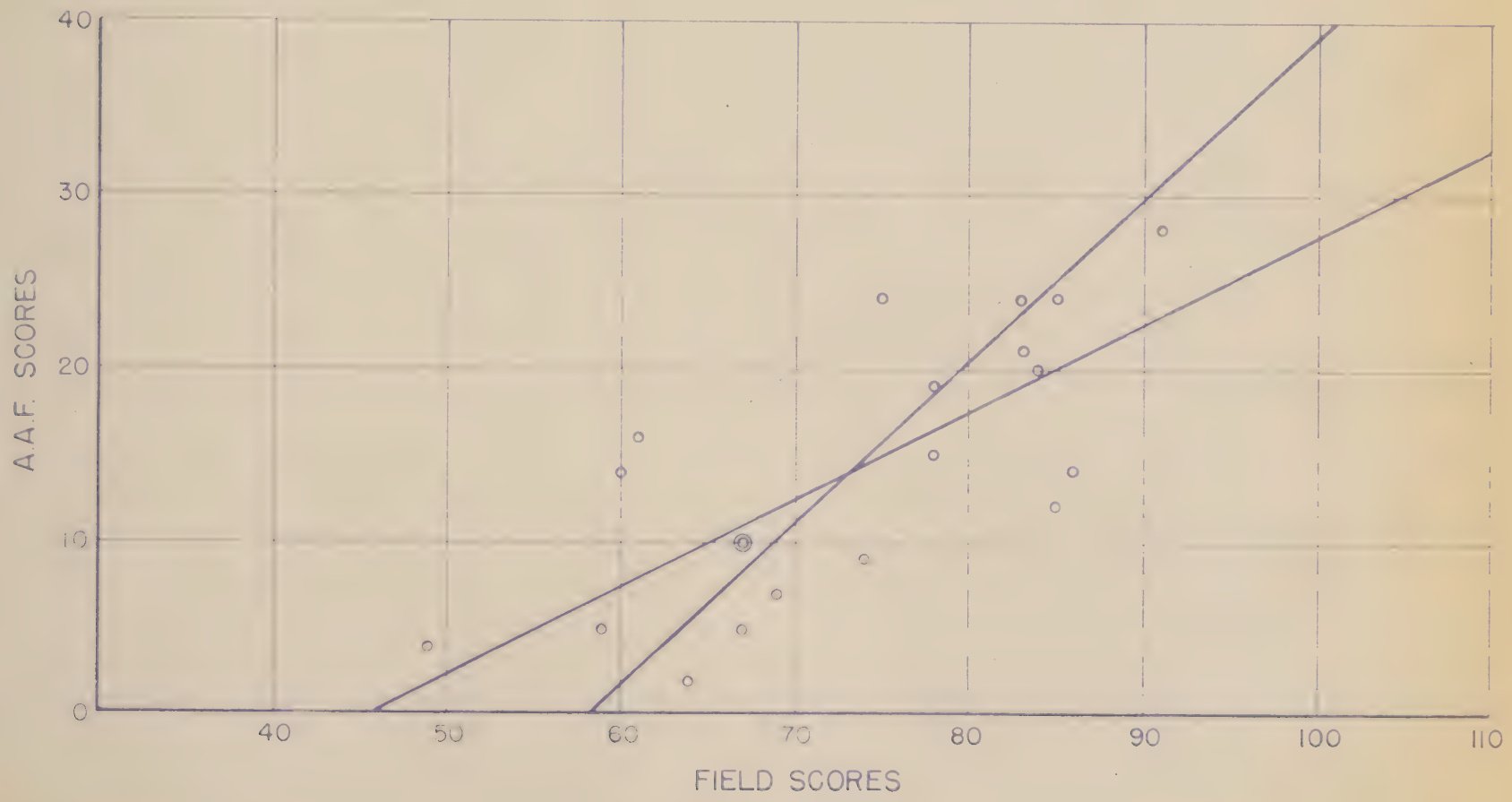
r = .0536
Mf = 18.85
MA.A.F. = 13.48

FIG. 19

FIG. 20

SCATTER DIAGRAM SHOWING RELATIONSHIP BETWEEN FIELD SCORES AND A.A.F. SCORES FOR GROUP A

SECOND TEST



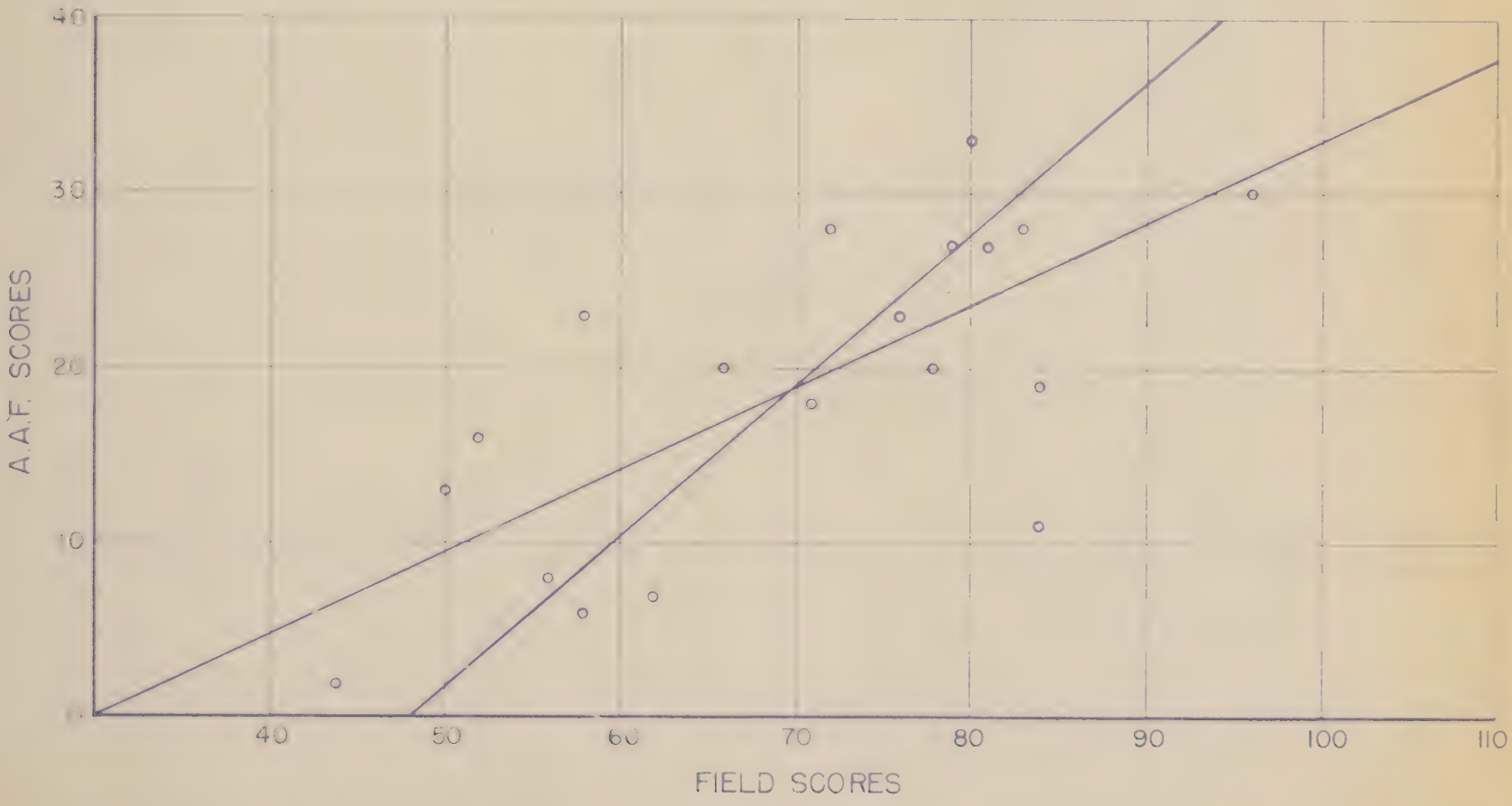
r.....= 0.727
M_F = 73.25
$M_{A.A.F.}$ = 14.15

FIG. 20

FIG. 21

SCATTER DIAGRAM SHOWING RELATIONSHIP BETWEEN FIELD SCORES AND A.A.F. SCORES FOR GROUP A

THIRD TEST



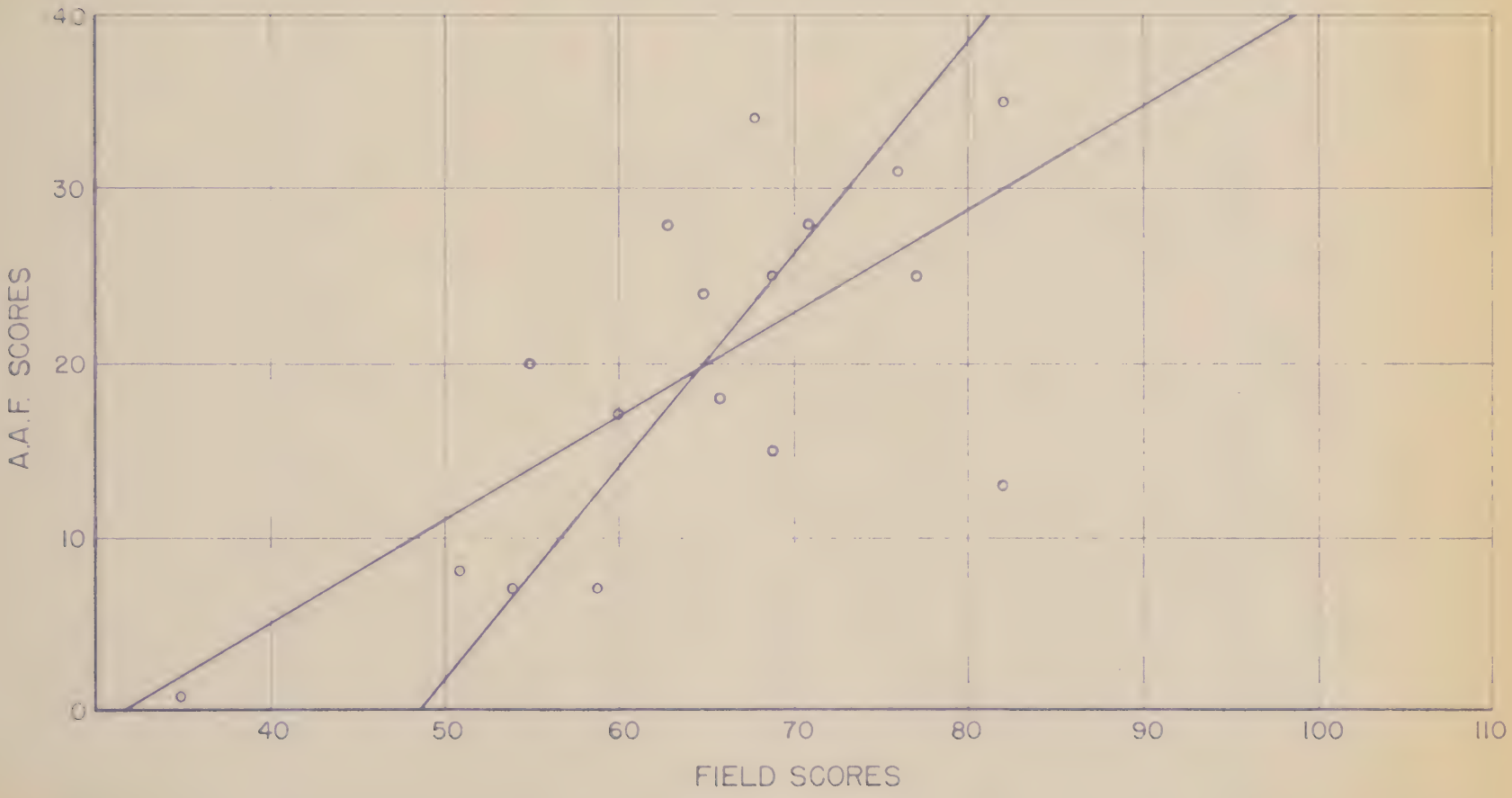
r..... = 0.741
MF ..... = 70.00
MA A F = 18.89

FIG. 21

FIG. 22

SCATTER DIAGRAM SHOWING RELATIONSHIP BETWEEN FIELD SCORES AND A.A.F. SCORES FOR GROUP A

FOURTH TEST



r..... = 0.698
MF = 64.82
MA.A.F. = 19.76

FIG. 22

FIG. 23

COMPARISON OF THE AVERAGES OF FOUR SUCCESSIVE FIELD SCORES OF INDIVIDUAL MEN WITH THEIR AVERAGES FOR FOUR SUCCESSIVE A.A.F. TESTS

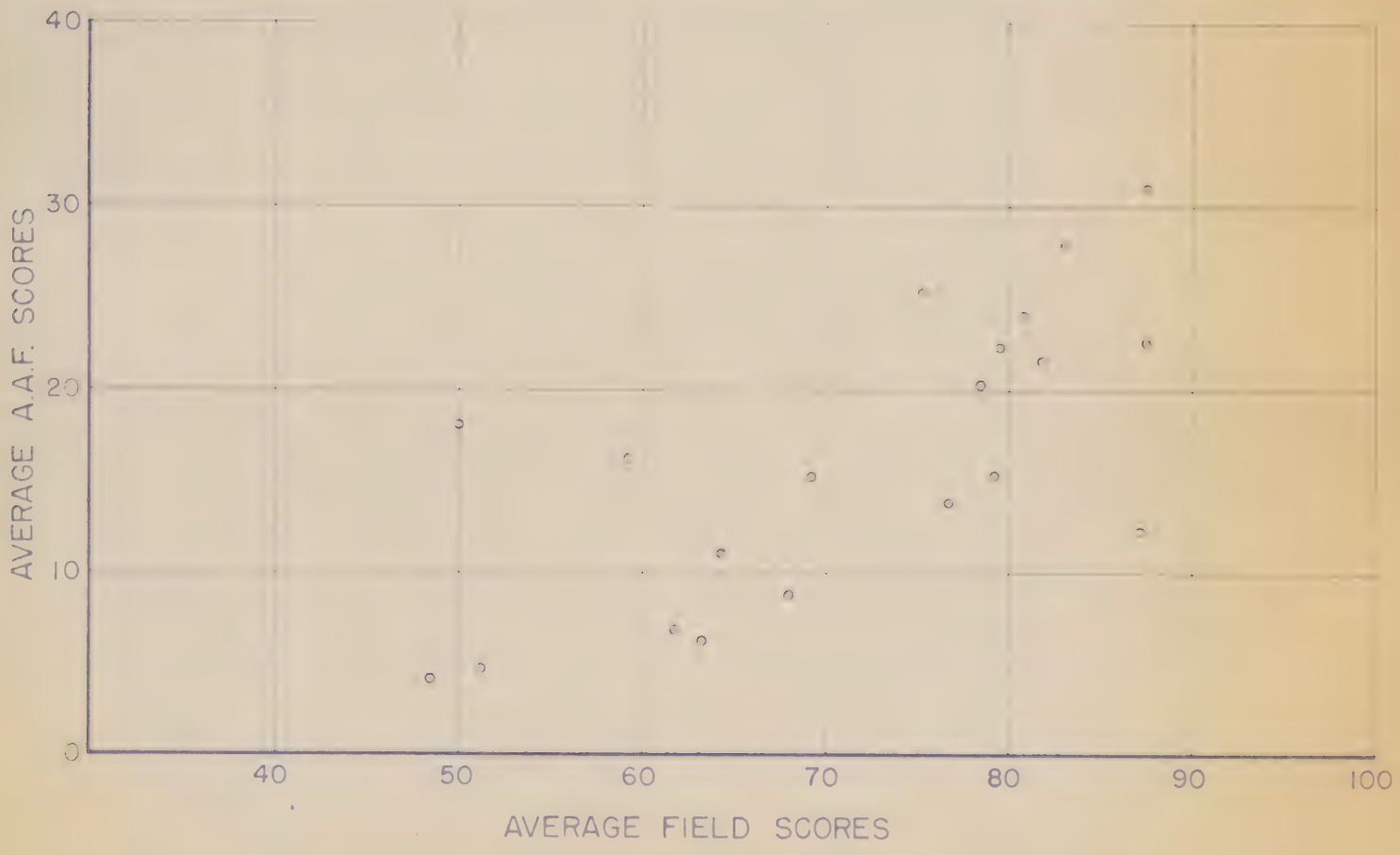


Chart 4-3

FIG. 23

FIG. 24

COMPARISON OF THE AVERAGES OF FOUR SUCCESSIVE FIELD SCORES OF INDIVIDUAL MEN WITH THEIR AVERAGES FOR FOUR LUCKIESH MOSS TESTS (0.0147 FT. LAMBERTS)

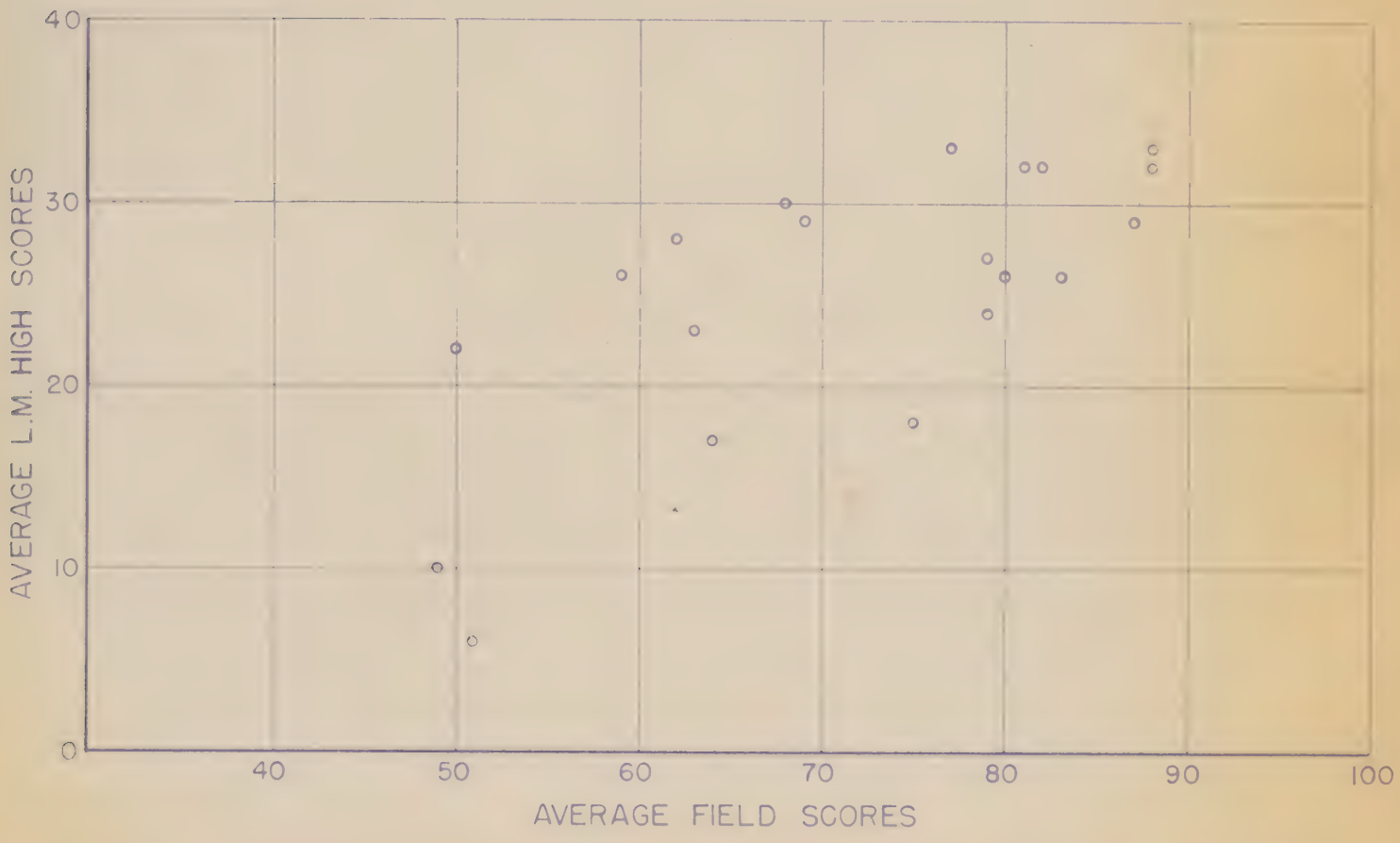


FIG. 24

FIG. 25

COMPARISON OF THE AVERAGES OF FOUR SUCCESSIVE FIELD SCORES OF INDIVIDUAL MEN WITH THEIR AVERAGES FOR FOUR LUCKIESH MOSS TESTS (0.0081 FT. LAMBERTS)

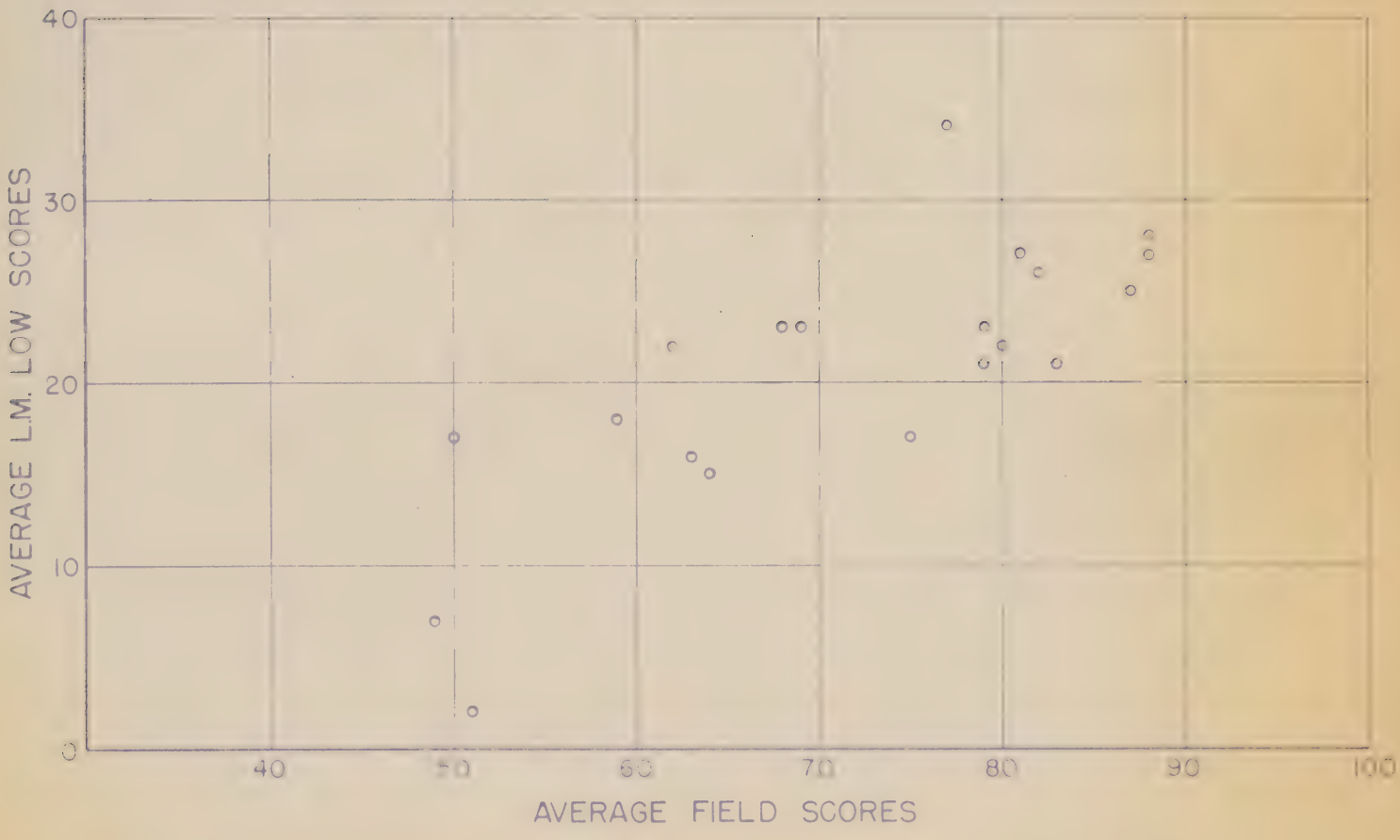


FIG. 25

FIG. 26

COMPARISON OF THE AVERAGES OF FOUR SUCCESSIVE FIELD SCORES OF INDIVIDUAL MEN WITH THEIR AVERAGES FOR FOUR LUCKIESH MOSS TESTS

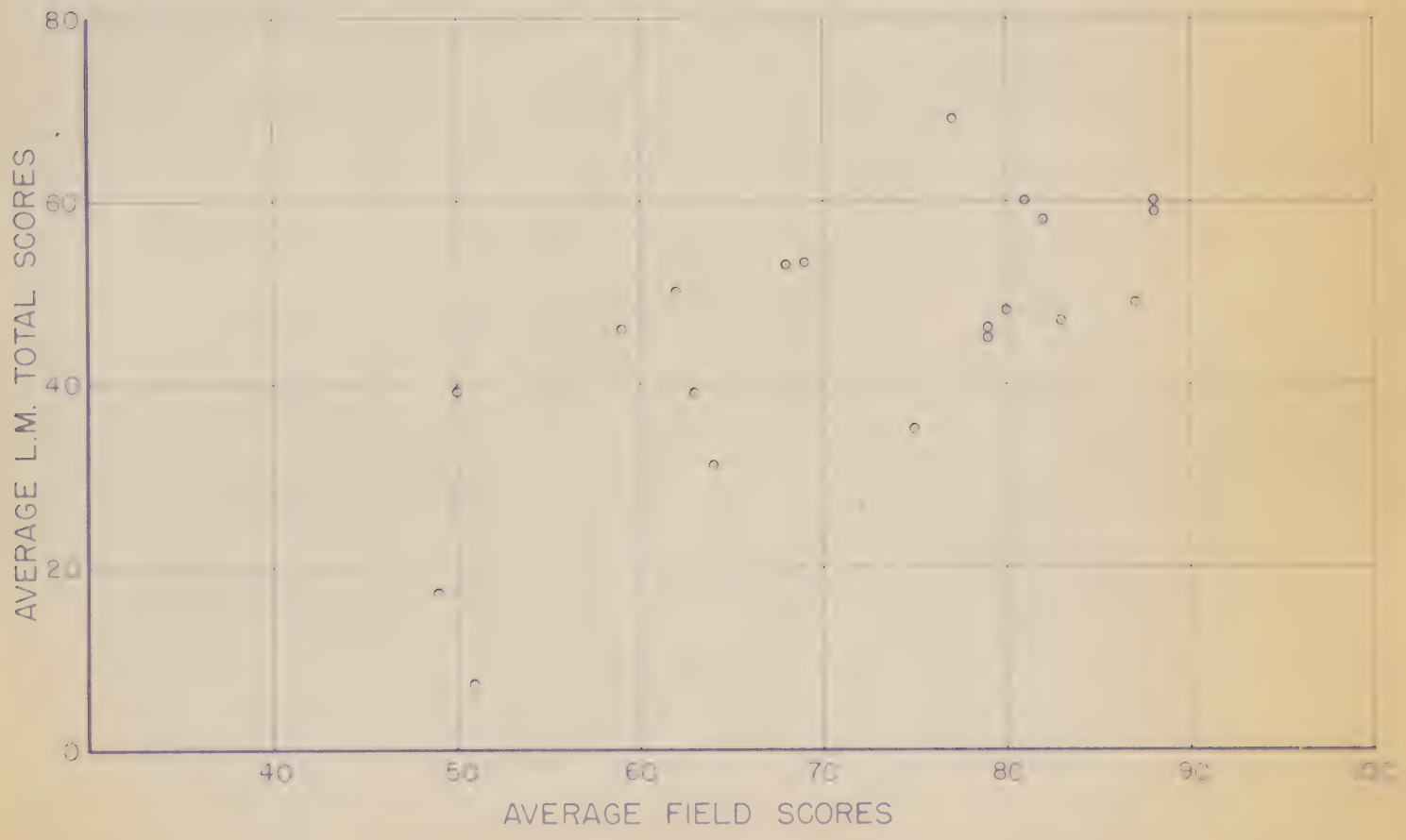
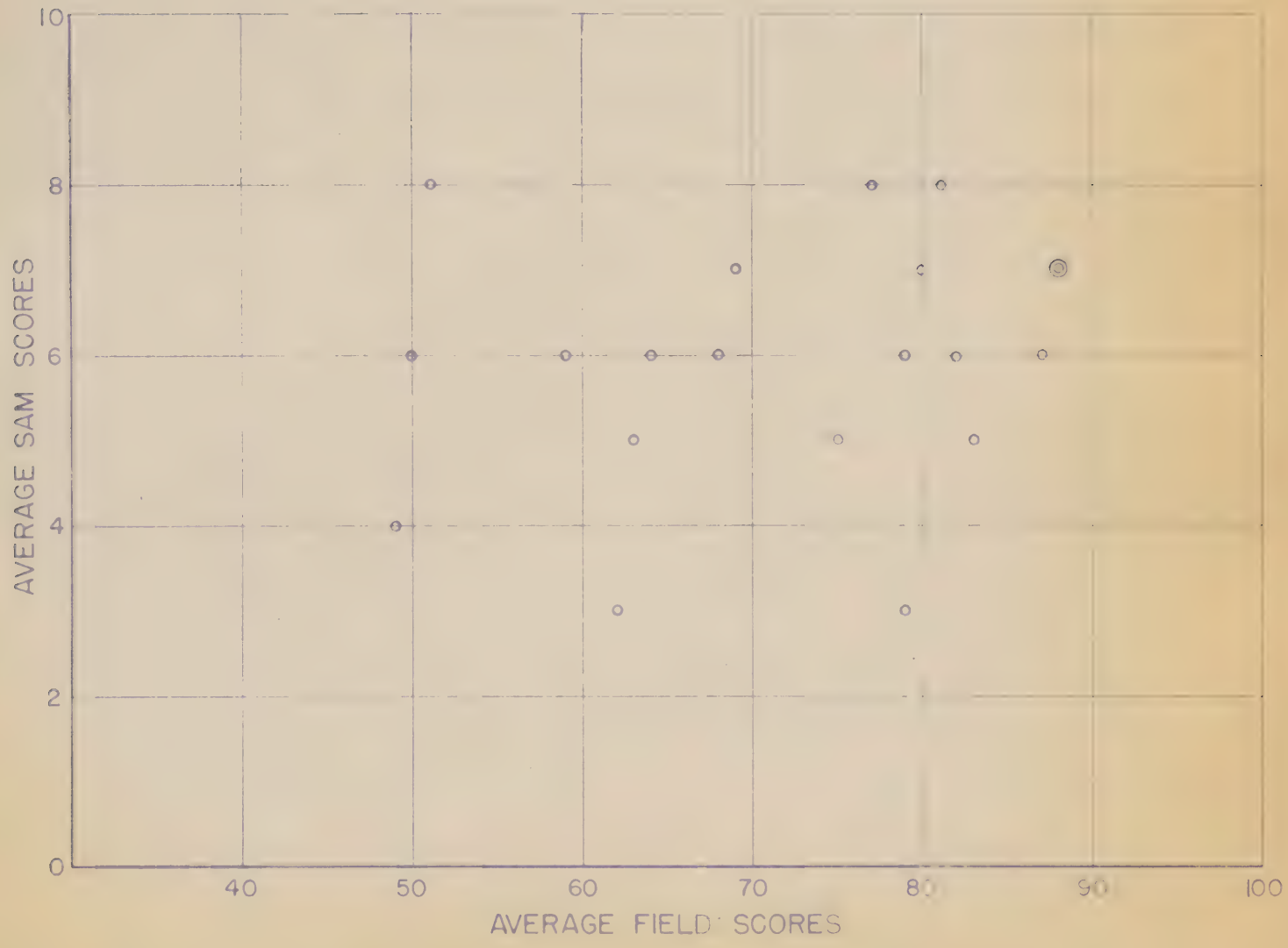


FIG. 26

FIG. 27

AVERAGE FIELD SCORES VS. AVERAGE S.A.M SCORES

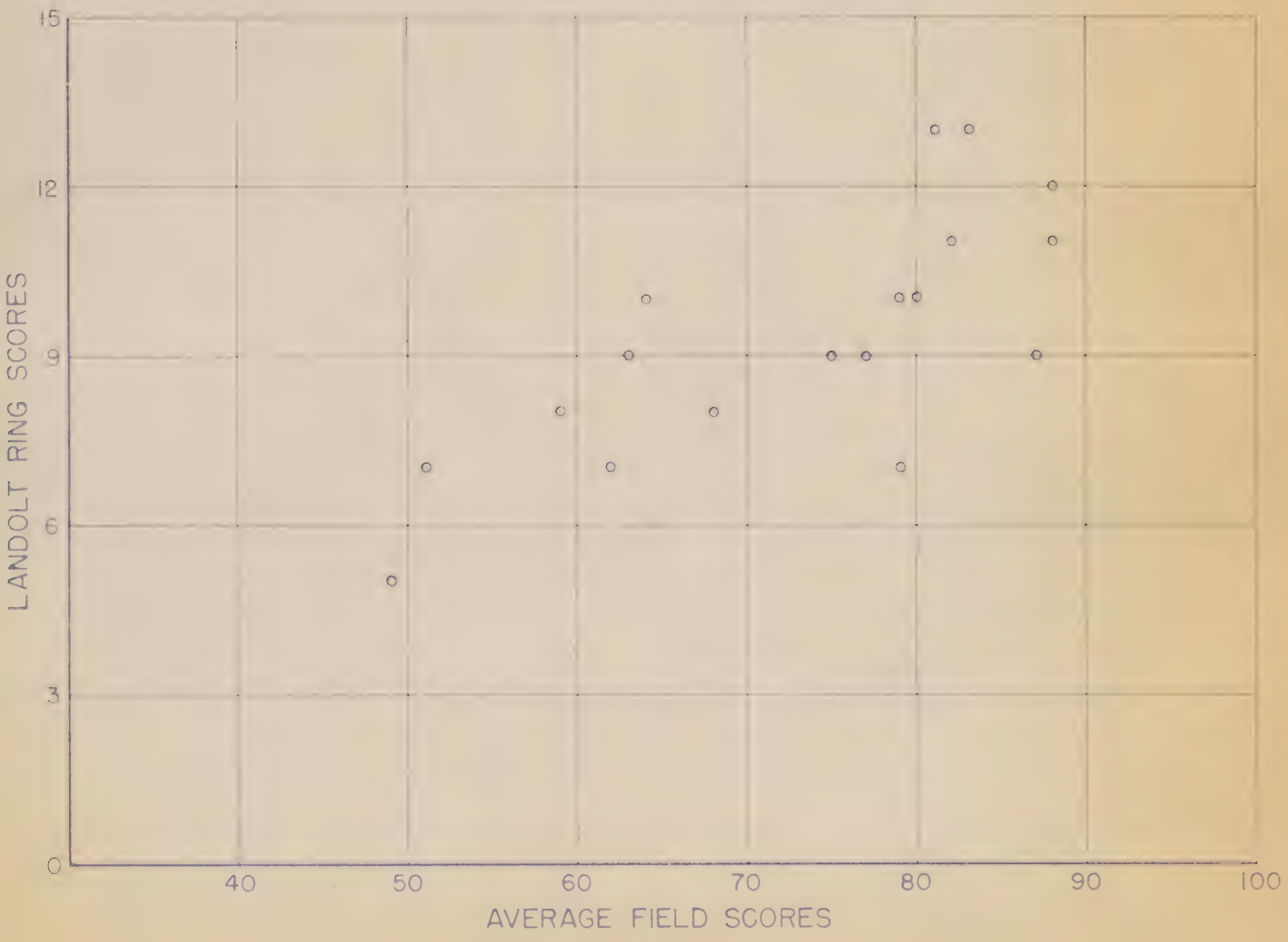


2 of 3

FIG 27

FIG. 28

AVERAGE FIELD SCORES VS. LANDOLT RING FIELD SCORES

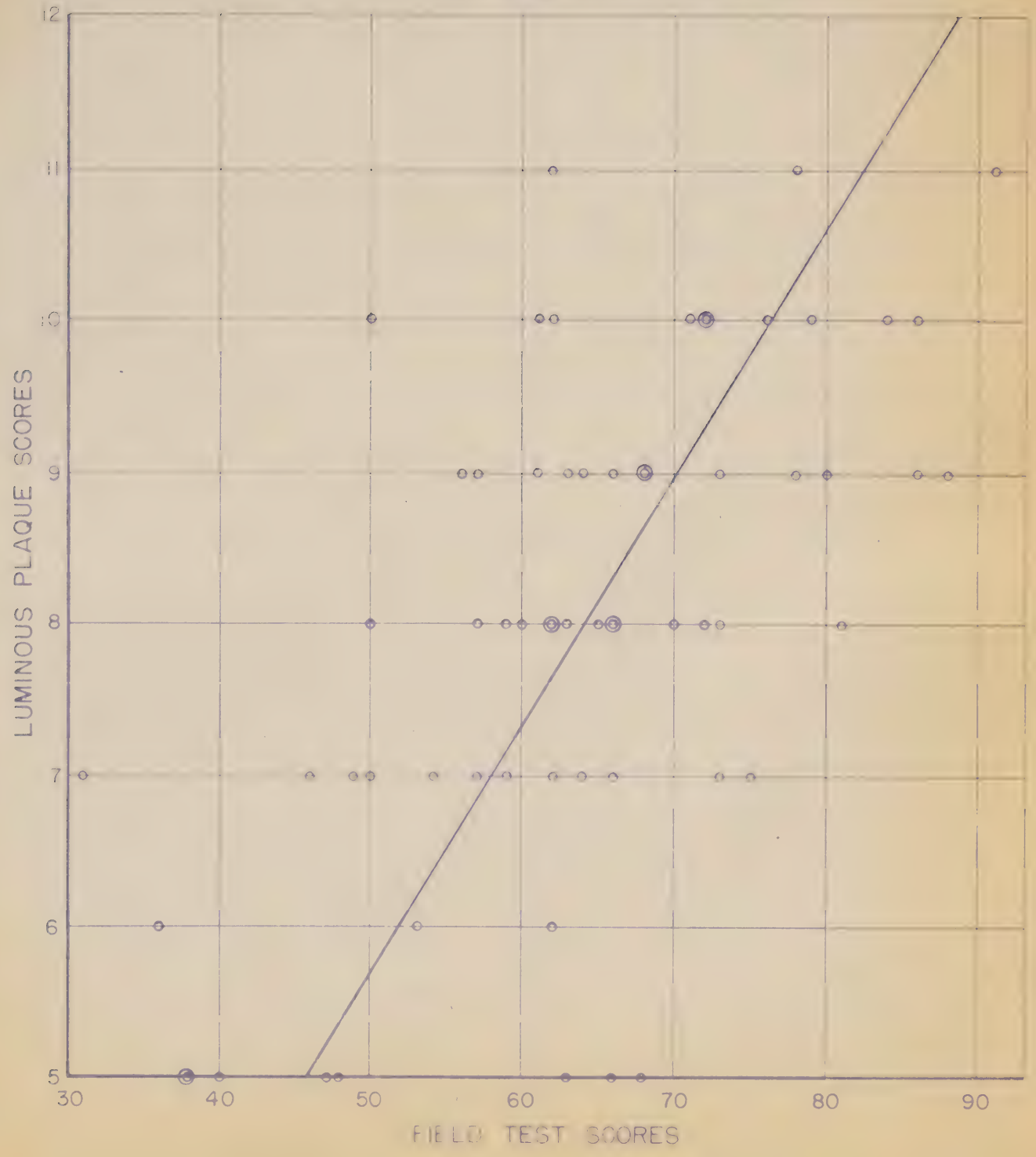


Sheet 3

FIG. 28

FIG. 29

COMPARISON OF INDIVIDUAL LUMINOUS PLAQUE SCORES AND FIELD TEST SCORES
(64 MEN)

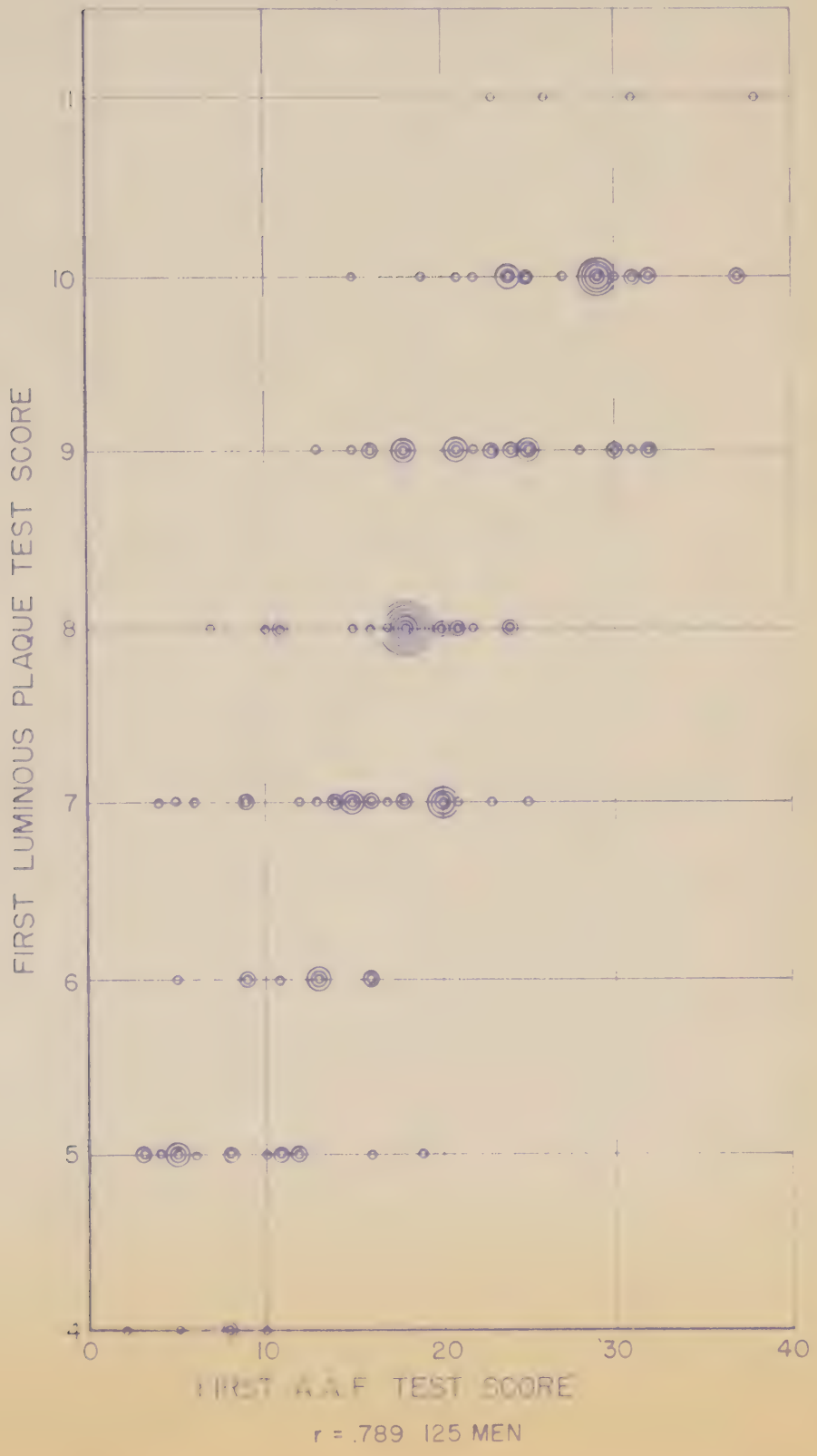


r = 0.585
M_F = 64.0
M_{LP} = 8.0

FIG. 29

FIG. 30

COMPARISON OF FIRST LUMINOUS PLAQUE TEST AND FIRST A.A.F. TEST (125 MEN)



r = .789 125 MEN

FIG. 30

FIG. 31

COMPARISON OF THE AVERAGES OF FOUR SUCCESSIVE LUMINOUS PLAQUE SCORES OF INDIVIDUAL MEN WITH THEIR AVERAGES FOR FOUR A.A.F. TESTS

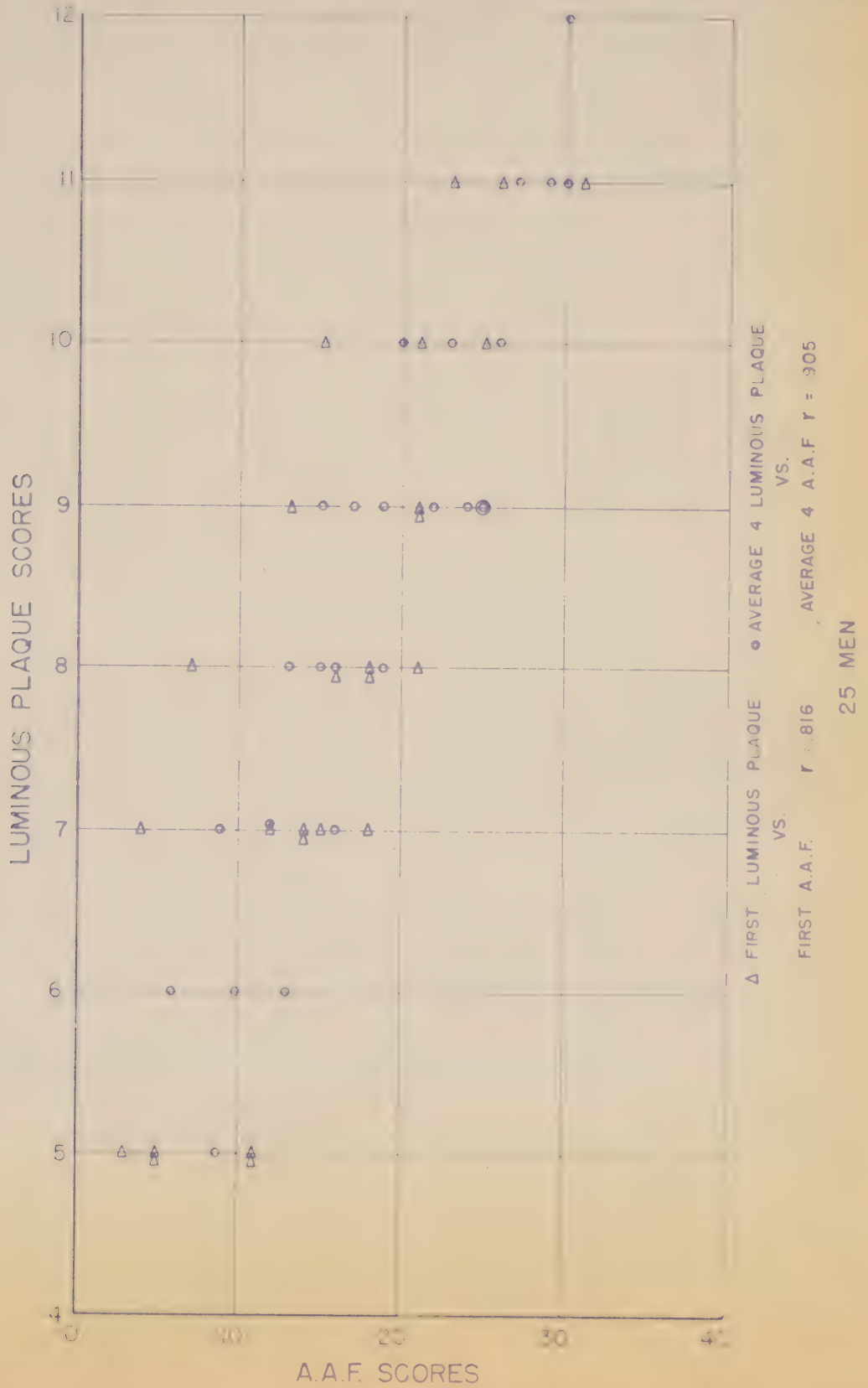


Fig. 31

FIG. 33

PERCENT LOW, MIDDLE AND HIGH BY FIELD TEST FOR SELECTED LOWEST PERCENT BY LUMINOUS PLAQUE TEST

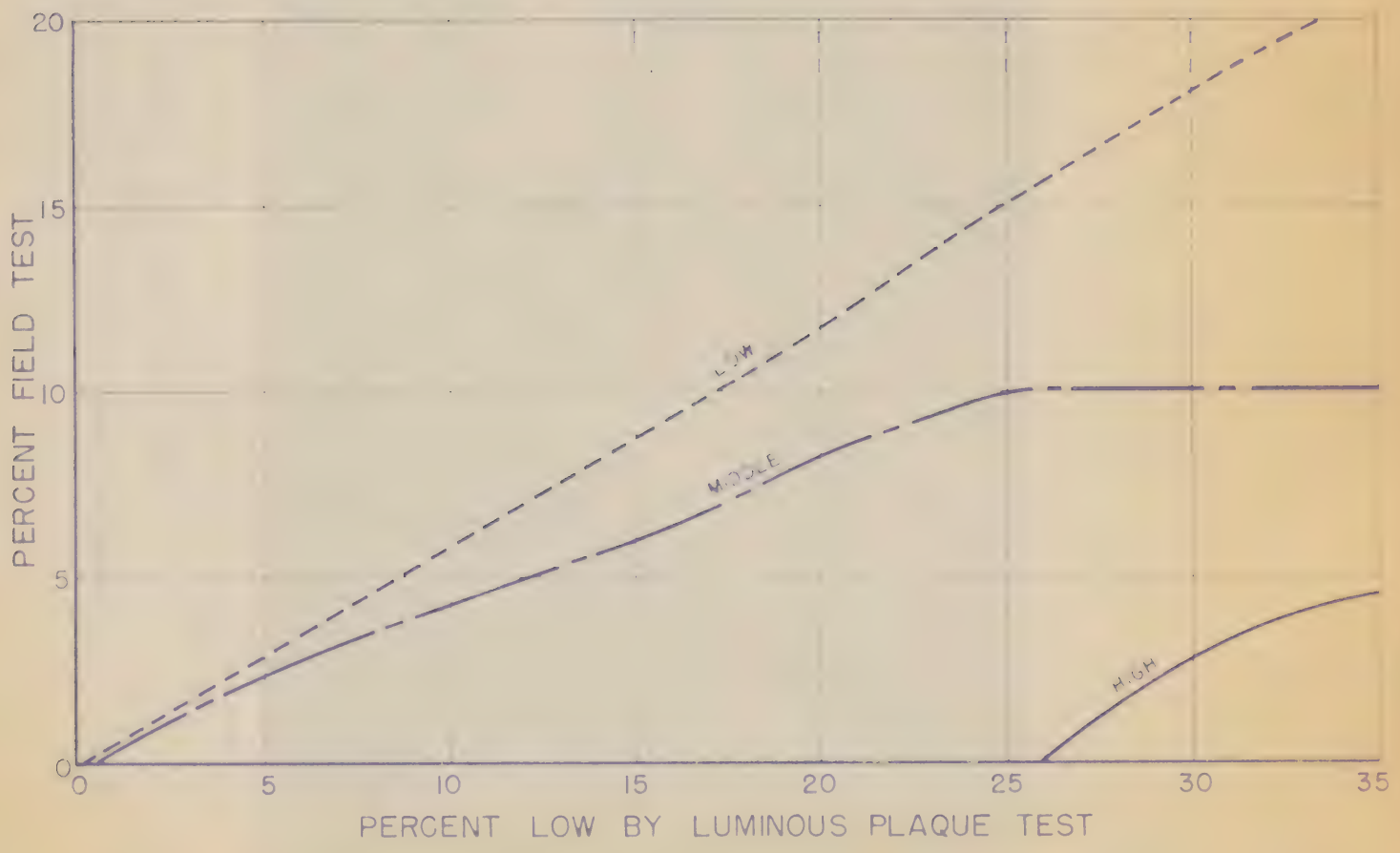


FIG. 33

1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY

FORT KNOX, KY.

Project No. 7-8 GENERAL VIEW OF FIELD TEST AREA (All targets not shown) #1

1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY

FORT KNOX, KY.

Project No. 7-8 TYPICAL ARRANGEMENT OF FIELD TEST TARGETS (Note Guide Tape) #2

1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY
FORT KNOX, KY.

Project No. 7-8 TYPICAL ARRANGEMENT OF FIELD TEST TARGETS #3

1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY

FORT KNOX, KY.

Project No. 7-8 ILLUSTRATING POSITION OF OPERATOR DURING FIELD TEST #4

1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY

FORT KNOX, KY.

Project No. 7-8 AAF TEST - SUBJECTS SEATED AT RECORDERS #5

1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY
FORT KNOX, KY.

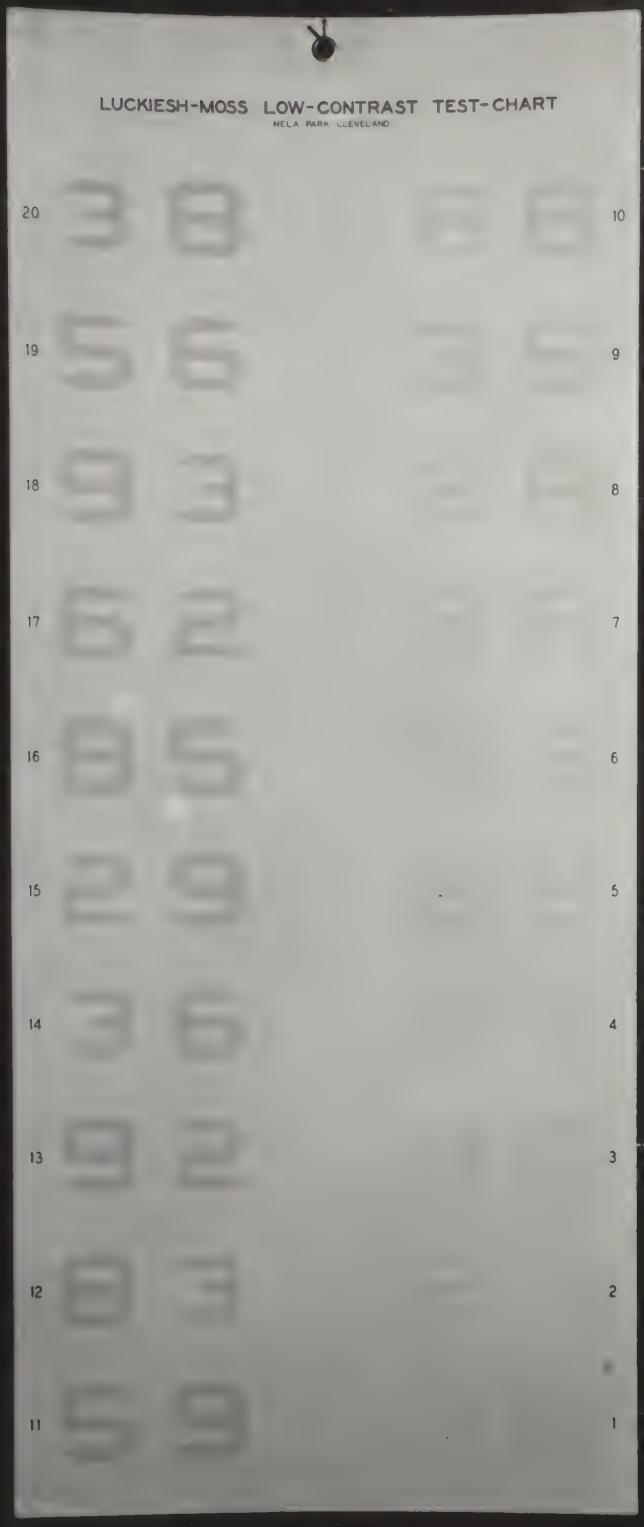
Project No. 7-8 TARGET OF AAF TESTER #6

1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY

FORT KNOX, KY.

Project No. 7-8 LUCKIESH-MOSS TEST (Subject writes numbers and advances paper with crank not shown) #7



1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY
FORT KNOX, KY.

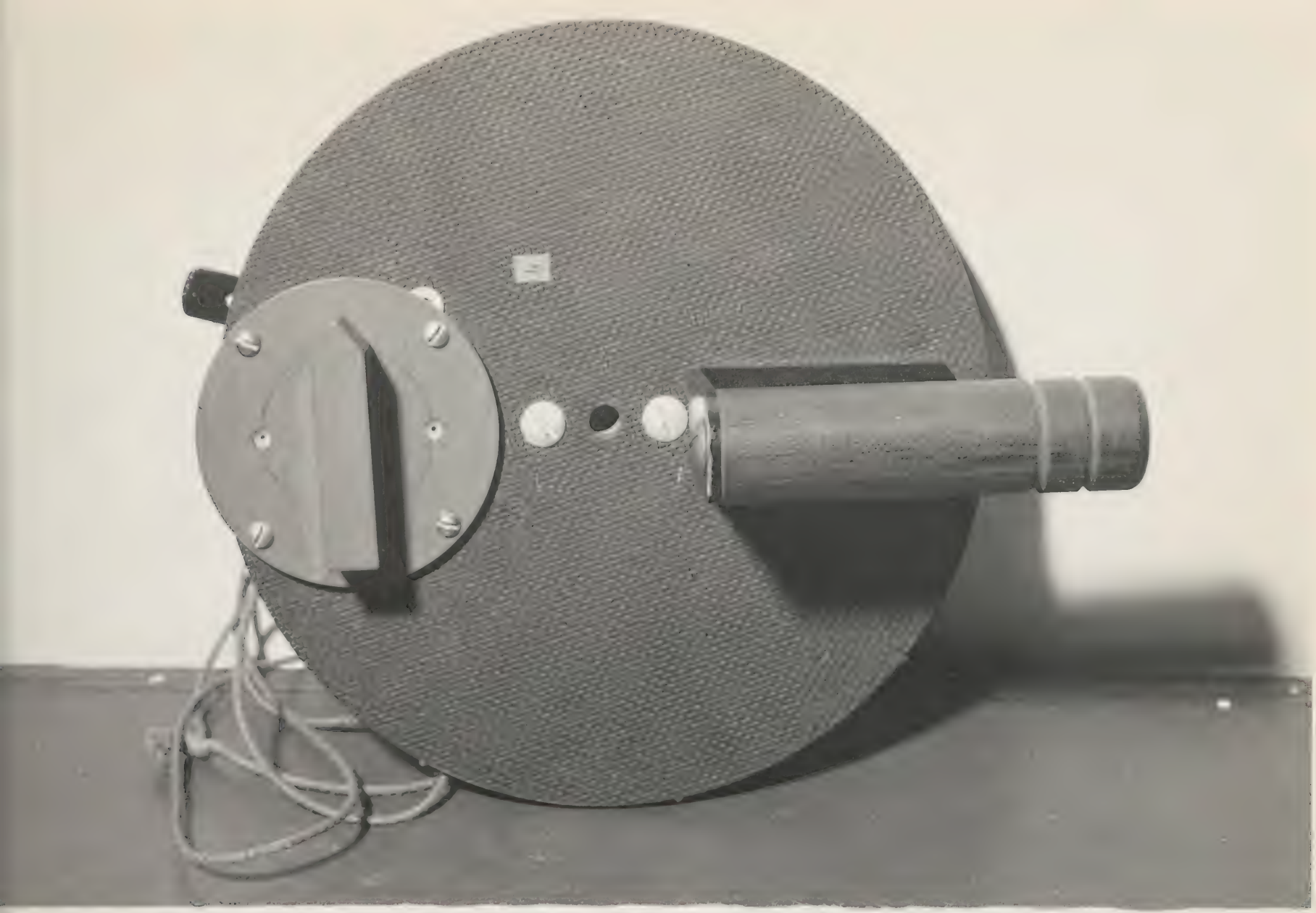
Project No. 7-8 LUCKIESH-MOSS TEST CHART #8

1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY

FORT KNOX, KY.

Project No. 7-8 S.A.M: TEST (Filters shown on front. Top disc only illuminated) #9



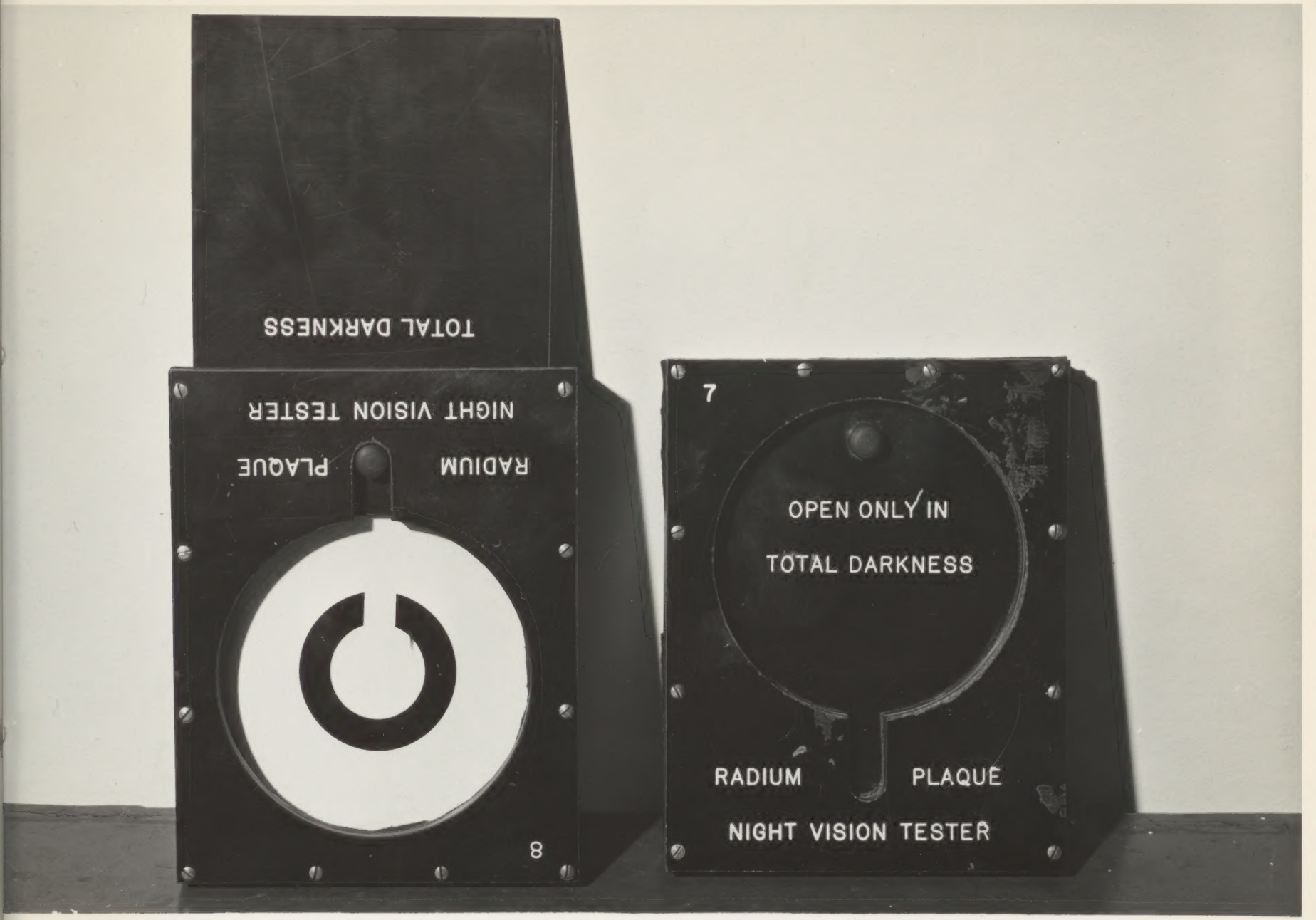
1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY

FORT KNOX, KY.

Project No. 7-8

REAR VIEW S.A.M. TESTER (Operator changes orientation of Landolt ring by rotation of fiber disc)#10



1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY
FORT KNOX, KY.

Project No. 7-8 LUMINOUS PLAQUE TESTER #11

1 May 1944

ARMORED MEDICAL RESEARCH LABORATORY
FORT KNOX, KY.

Project No. 7-8 LUMINOUS PLAQUE TEST (Showing measuring tape (Note tabs) #12